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DRAFT

QUALITY ASSURANCE PROJECT PLAN VOLUME I

REMEDIAL ACTION

PRE-FINAL DESIGN
ENVIRO-CHEM SUPERFUND SITE
ZIONSVILLE, INDIANA

Prepared For:

ENVIRONMENTAL CONSERVATION AND CHEMICAL CORPORATION TRUST

Prepared By:

AWD TECHNOLOGIES, INC.
INDIANAPOLIS, INDIANA

AWD PROJECT NUMBER 2259

DECEMBER 1992

NOTICE

"This document is a portion of the overall design package and, therefore, cannot be referenced, in whole or in part, as a standalone document for any other purpose. As indicated in the cover letter of transmittal for these plans, and the Report of Response to U.S. EPA's comments, these plans will be updated and finalized once the Supplemental Investigation data is evaluated.

Signature page

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1.0 PROJECT DESCRIPTION

1.1 Introduction

This Quality Assurance Project Plan (QAPP) has been developed and is being submitted in accordance with Exhibit A to the Consent Decree for the Remedial Action to be conducted at the Environmental Conservation and Chemical Corporation (ECC) Site, located in Zionsville, Indiana. The QAPP addresses all quality assurance requirements for sampling and analyses during the Site Remedial Actions. The sampling and analyses activities for Remedial Action are described in the Field Sampling Plan for Remedial Action which is submitted as Volume II of the QAPP.

This QAPP presents the organization, objectives, functional activities, and specific quality assurance (QA) and quality control (QC) activities associated with the sampling to be conducted as part of the remedial activities at the ECC Site. The plan has been prepared in accordance with the U.S. Environmental Protection Agency (U.S. EPA) document "Internal Guidelines and Specifications for Preparing Quality Assurance Project Plans" (QAMS-005/80), "Content Requirements for Quality Assurance Project Plans" prepared by Dr. Chen-Wen Tsai of U.S. EPA Region V (undated), and the Region V "Model QAPP" (May 1991). In addition, the Data Quality Objectives (DQOs) were developed in accordance with the U.S. EPA's "Data Quality Objectives for Remedial Response Activities" (March 1987).

ERM-North Central has previously submitted a number of versions of a two-part Sampling and Analysis Plan for the ECC Site which contained a Part I - Field Sampling Plan and a Part II - Quality Assurance Project Plan. The Sampling and Analysis Plan addressed site preparation, material removal and remedial action activities, although the plan primarily focused on remedial action activities.

The previous ERM-North Central submittals of the Sampling and Analysis Plans and the corresponding U.S. EPA Region V comments are as follows:

1. Sampling and Analysis Plan, Revision 0, March 1, 1989
2. Sampling and Analysis Plan, Revision 1, December 10, 1991
3. U.S. EPA Region V Comments on Revision 1, February 21, 1992
4. Sampling and Analysis Plan, Revision 2, March 24, 1992

AWD Technologies, Inc. (AWD) has revised the ERM-North Central Sampling and Analysis Plan, Revision 2, to further address the U.S. EPA comments. The previous Sampling and Analysis Plan two-part format has been modified to include the Field Sampling Plan as part of the Quality Assurance Project Plan. The Sampling and Analysis Plan terminology is not used in the AWD plans.

The Pre-Final Design for the ECC Site has been further modified to include two design packages: (1) Site Preparation and Material Removal and (2) Remedial Action. The Site Preparation and Material Removal phase includes preparation of the support zone and removal of above ground tanks, buildings, drums, and miscellaneous debris. The Remedial Action phase includes in-situ soil treatment by soil vapor extraction, capping of the soil treatment area, and verification and compliance monitoring.

The Pre-Final Design QAPP for the Remedial Action has been prepared primarily to address the U.S. EPA February 21, 1992 comments, where possible. The Final Design Technical Specifications and Drawings for the Remedial Action have not been submitted in conjunction with the Final Design Plans since additional supplemental site investigations must be completed prior to completion of the Remedial Action Final Design. The plans for Remedial Action will be further revised, as necessary, and resubmitted to U.S. EPA with the Remedial Action Final Design Technical Specifications and Drawings.

The Remedial Action scope of work includes the following:

- Installation and operation of an in situ soil vapor extraction (SVE) system.
- Installation of a final cover over the soil treatment area.
- Implementation of access restrictions.
- Monitoring of vapor, soil, and subsurface and surface water to evaluate the effectiveness of the remediation activities.

The sampling and analysis activities to be conducted at the Site include the following:

- Analysis of extracted soil vapor for selected volatile organic compounds (VOCs) and phenol.

- Analysis of soil samples for selected VOCs and base neutral/acid organics (BNAs).

- Analysis of surface and subsurface water for selected VOCs, BNAs, PCBs, and inorganics.

More details are given on sampling and analysis in the Remedial Action FSP and in later sections of this QAPP.

The following analytical laboratories have been identified as possible resources for performance of sample analysis: Lancaster Laboratories, CompuChem Laboratories, Warzyn Engineering, Inc. and IEA, Inc. At the time of the writing of this revision to the QAPP (AWD, December 1992), it is not known whether the Remedial Contractor will retain these laboratories for the ECC Site or contract with other qualified laboratories. All laboratories selected by the Remedial Contractor will be approved by the Environmental Conservation and Chemical Corporation Trust (ECC Trust) and U.S. EPA/IDEM prior to performance of any analytical work. In the event that other laboratories are chosen, these new laboratories will be required to:

- Use U.S. EPA SWA-846 methods where feasible.

- Modify analytical methods or employ alternate methods to achieve the project required detection limits listed in Table 3-1 of the QAPP. Whenever modified methods are employed, the laboratories are to describe such modifications in detail, such as was done by CompuChem in Appendix A.8 (Volume III) to the QAPP. If alternate or special methods (SAS) are to be employed, the laboratory must submit a standard operating procedure (SOP) for the method.

- List method detection limits for modified or alternate methods.

- Include all quality control information for modified or alternate methods. These include: frequency of, preparation of, analysis, concentrations and acceptance control limits of QC samples (spiked samples, method blanks, MS/MSD and continuing calibration checks). Only a higher level of QA/QC than presently listed will be accepted as an acceptable change.

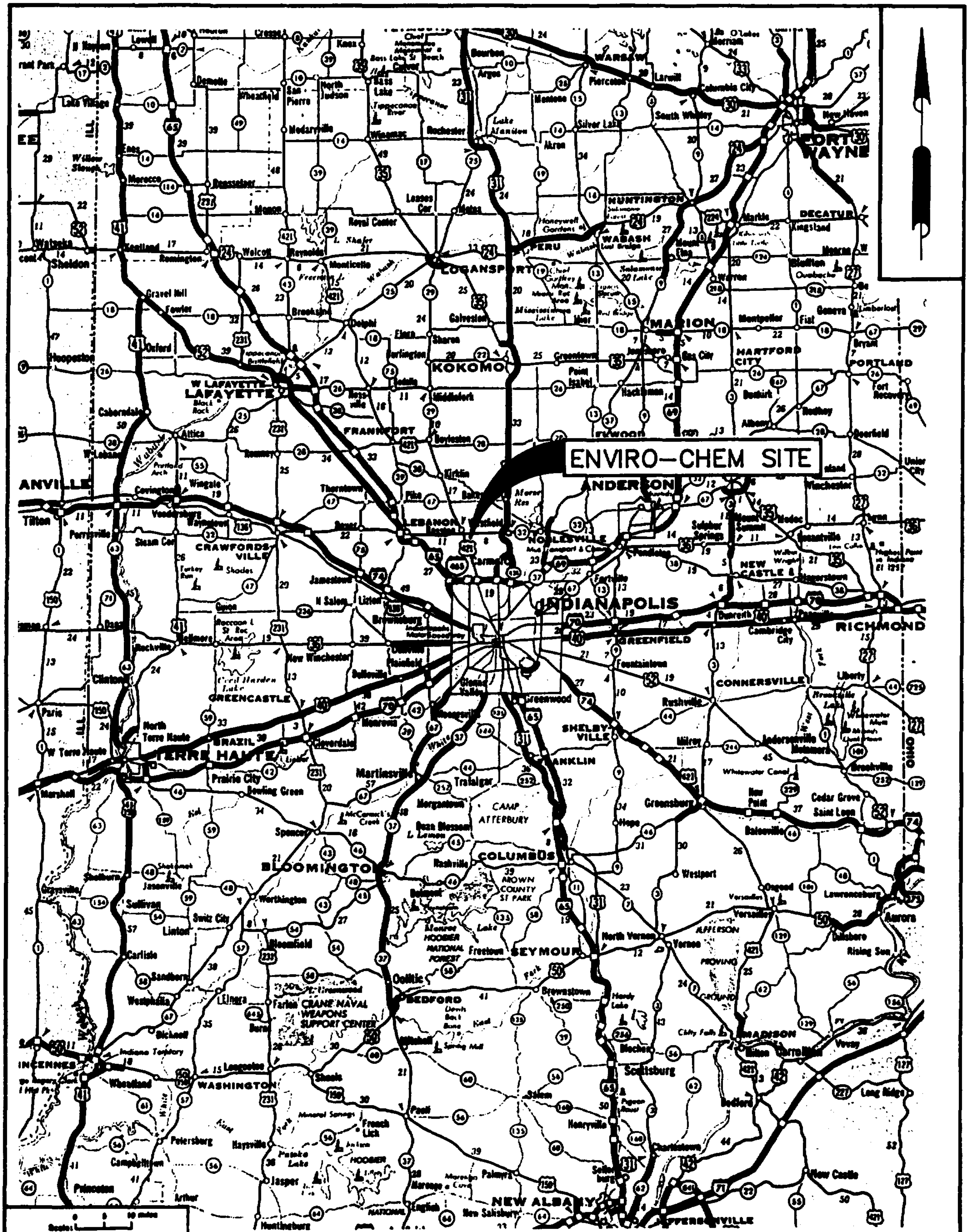
- Specify calibration range and dynamic linear range in appropriate units.

- Describe the methodology to be used to detect and quantify low concentration contaminants in the present of contaminants of high concentrations.

1.2 Site Description

1.2.1 Site Location

The ECC Site is located in a rural area of Boone County, about 5 miles north of Zionsville and 10 miles northwest of Indianapolis, Indiana (Figures 1-1 and 1-2).



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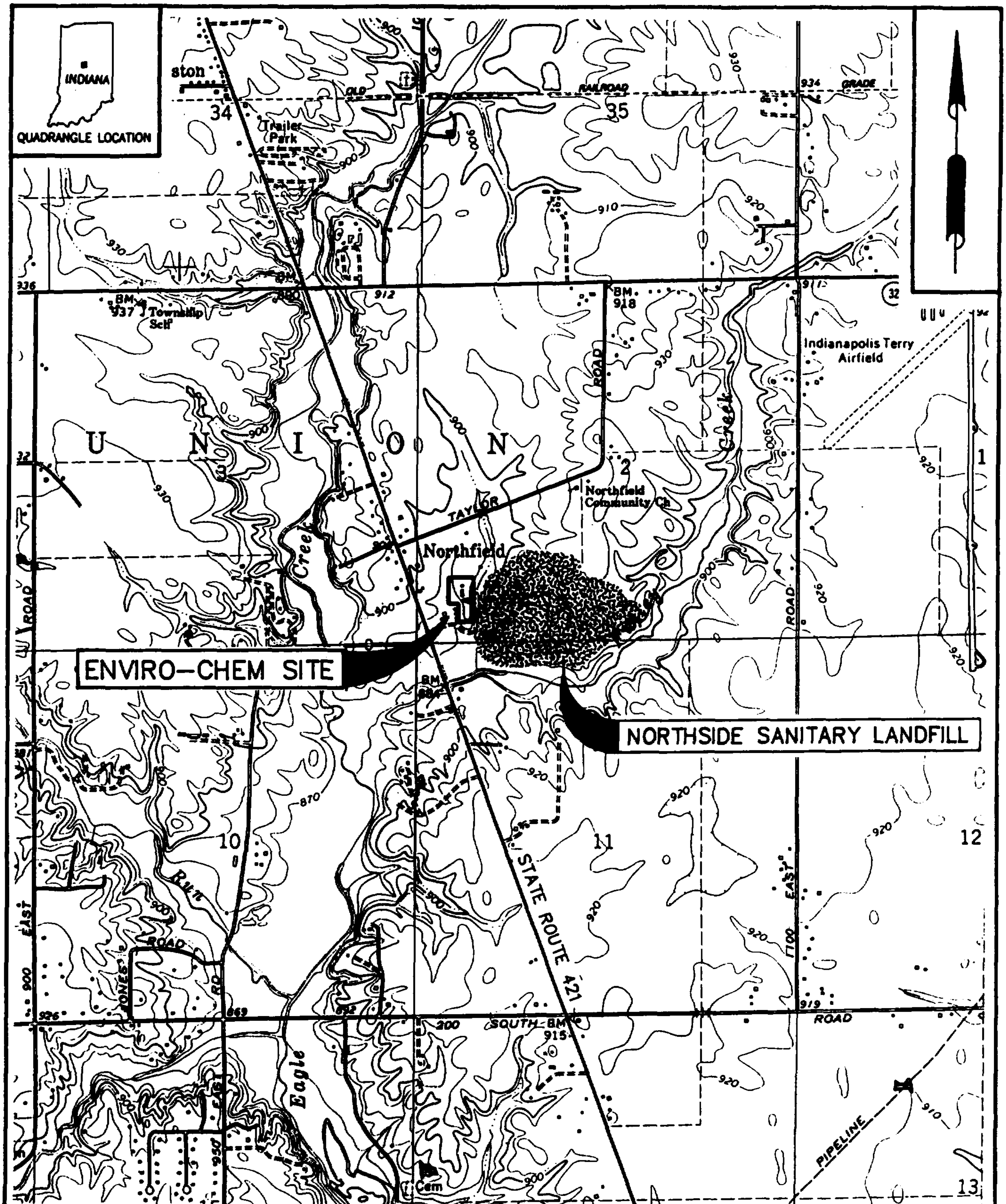
SITE LOCATION MAP
ENVIRO-CHEM SITE, ZIONSVILLE, IN

SCALE	AS SHOWN	FIGURE NUMBER	1-1	REV 0



0 2000 4000

SCALE IN FEET

BASE MAP IS A PORTION OF THE USGS ROSSTON, IN QUADRANGLE.
7.5 MINUTE SERIES. PHOTOREVISED 1987.

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SITE MAP
ENVIRO-CHEM SITE, ZIONSVILLE, IN

SCALE:	AS SHOWN	FIGURE NUMBER	1-2	REV 0

1.2.2 Site Description

The Site is defined as the area bounded by the proposed perimeter fence, which includes the 3.053-acre remedial boundary, the support zone, and the buffer zone between the proposed fence and the north and eastern sides of the Site. A buffer zone on the southern side of the Site contains a proposed Remedial Contractor equipment laydown area.

Directly west of the Site is an active commercial waste handling and recycling facility operated by the Boone County Resource Recovery Systems, Inc. (BCRRS). Access to the Site will be from State Route 421 and will be within a property easement shared with BCRRS.

Directly east of the Site across an unnamed ditch is the inactive Northside Sanitary Landfill (NSL) landfill. This facility is also a Superfund Site and is presently undergoing remedial design activities. The south end of the Site is approximately 500 feet from an existing residence and is approximately 400 feet from Finley Creek, the main surface water drainage in the site area.

Residential properties are also located to the north and west, within 1/2 mile of the facilities. A small residential community, Northfield, is located north of the Site on State Route 421. Approximately 50 residences are located within 1 mile of the Site.

The Site is in an area that is gently sloping, predominantly to the east towards the unnamed ditch. The unnamed ditch runs north to south along the eastern edge of the Site and drains the Site either directly or from tributary ditches on the north and south ends of the Site. The unnamed ditch flows south from the Site to Finley Creek.

Various solid waste materials are present at the Site both within the remedial boundary and within the support zone. Emergency actions undertaken prior to 1990 have resulted in the removal of the major sources of contamination. The materials at the Site include cleaned tanks, the process building, the A-frame structure, the concrete pad with approximately 250 drums, and miscellaneous debris. These materials will be removed under a separate contract prior to implementation of the Remedial Action.

1.2.3 Site History

In 1977, ECC began operations at the Site, which consisted of the recovery, reclamation, and brokering of primary solvents, oils, and other wastes. Waste products were received in drums and bulk tankers and prepared for subsequent reclamation or disposal. Processes to reclaim solvents and oil included distillation, evaporation, and fractionation.

U.S. EPA investigations concerning the accumulation of contaminated stormwater onsite, improper drum inventory, and several spill incidents lead to civil law suits, and finally the placement of ECC into receivership in July 1981. Drum shipments to the Site were halted in February 1982. Surface cleanup activities conducted by U.S. EPA contractors during 1983 and 1984 included the removal of cooling pond waters, waste drums, tank wastes, contaminated soil, and cooling pond sludge.

A Remedial Investigation/Feasibility Study (RI/FS) was conducted by CH2M Hill for the U.S. EPA from 1983 through 1986. A summary of the data gathered during the RI is presented in Table 1-1. The Record of Decision (ROD) for the Site was published on September 25, 1987 and amended on June 7, 1991, and the Consent Decree for the remediation of the Site was entered on September 10, 1991.

Geology & Hydrogeology

TABLE 1-1

SUMMARY OF REMEDIAL INVESTIGATION DATA[1]
ECC SITE

Parameter	Soil[2] Minimum[3]	Soil[2] Maximum[3]	Sediments Minimum[3]	Sediments Maximum[3]	Subsurface Water Minimum (μg/l)	Subsurface Water Maximum (μg/l)	Offsite Surface Water Minimum (μg/l)	Offsite Surface Water Maximum (μg/l)
VOLATILES								
Benzene					ND/4 J	9 K		
Chlorobenzene	ND/360	360						
1,1,1-Trichloroethane	ND/3 J	1,100,000			ND/5 K	7	ND/6	120
1,1-Dichloroethane	ND/380 J	380 J			ND/51.2	96	ND/45	45
1,1,2-Trichloroethane	ND/14	550						
Chloroethane					ND/29	120	ND/12	12
Chloroform	ND/5 J	2,900			ND/3 JB	9 K		
1,1-Dichloroethene	ND/47	35,000 B			ND/6	10		
Trans-1,2-Dichloroethene	ND/9	120,000 B			ND/3 J	4,000	ND/6 d	330
Trans-1,3-Dichloropropene					ND/77.5	77.5		
Ethyl Benzene	ND/14	1,500,000			ND/3 J	9 K	ND/2 d	13 d
Methylene Chloride	ND/8	310,000	ND/6.1	9.1	ND/2 J	64	ND/3 d	86
Trichlorofluoromethane			ND	ND	ND	ND		
Tetrachloroethene	ND/5 J	650,000			ND/9 K	9 K	ND/5 d	29
Toluene	ND/6	2,000,000			ND/9 K	9 K	ND/6	82

TABLE 1-1

SUMMARY OF REMEDIAL INVESTIGATION DATA[1]
ECC SITE

	Soil[2]		Sediments		Subsurface Water		Offsite Surface Water	
Parameter	Minimum[3]	Maximum[3]	Minimum[3]	Maximum[3]	Minimum (μg/l)	Maximum (μg/l)	Minimum (μg/l)	Maximum (μg/l)
Trichloroethene	ND/3 J	4,800,000 B			ND/3 J	28,000	ND/13	240
Vinyl Chloride	ND/7	7			ND/6	85.8	ND/10	11
Acetone	ND/16	650,000			ND/9 KB	15,030 B	ND/30	1,100
2-Butanone	ND/6 J	2,800,000			ND/9 K	26 B	ND/16	560
4-Methyl-2-Pentanone	ND/35 J	190,000						
Styrene					ND/5 K	5 K		
o-Xylene							ND	ND
Total Xylenes	ND/11	6,800,000			ND/9	12	ND/11	47
ACID EXTRACTABLES								
p-Chloro-m-Cresol							ND/30 d,e	30 d,e
Phenol	ND/610	570,000					ND/92 e	92 e
2-Methylphenol	ND/340	340					ND/27 e	27 e
4-Methylphenol	ND/53,000	53,000					ND/89 e	120 e

Parameter	Soil[2]		Sediments		Subsurface Water		Offsite Surface Water	
	Minimum[3]	Maximum[3]	Minimum[3]	Maximum[3]	Minimum ($\mu g/l$)	Maximum ($\mu g/l$)	Minimum ($\mu g/l$)	Maximum ($\mu g/l$)
BASE/NEUTRALS								
1,2-Dichlorobenzene	ND/240	900,000						
Fluoranthene					ND/20 K	20 K		
Isophorone	ND/270	440,000			ND/20 K	20 K	ND/86 e	ND/240 e
Naphthalene	ND/640	180,000						
bis(2-Ethylhexyl)phthalate	ND/230	370,000	ND/912	912	ND/23 K	23 K	ND	ND
Butyl Benzyl Phthalate	ND/400 J	47,000						
Di-n-Butyl Phthalate	ND/53	8,200						
Di-n-Octyl Phthalate	ND/310	2,100					ND/17 d,e	17 d,e
Diethyl Phthalate	ND/1,200	9,000			ND/20 K	20 K		
Dimethyl Phthalate	ND/360 J	1,300						
Chrysene					ND/20 K	20 K		
Fluorene	ND/260	260						
Phenanthrene	ND/350	8,100						
Pyrene					ND/30	30		
2-Methylnaphthalene	ND/1,900	2,100						

TABLE 1-1

SUMMARY OF REMEDIAL INVESTIGATION DATA[1]
ECC SITE
PAGE 4 OF 6

	Soil[2]		Sediments		Subsurface Water		Offsite Surface Water	
Parameter	Minimum[3]	Maximum[3]	Minimum[3]	Maximum[3]	Minimum (μg/l)	Maximum (μg/l)	Minimum (μg/l)	Maximum (μg/l)
PCB-1232	ND/340 C	540 C						
PCB-1260	ND/750	39,000						
INORGANICS								
Aluminum	1,920	44,800	2,172	9,744	ND/[65]	61,500	ND/[69]a	3,050 a
Antimony	ND/42	42	ND	ND	ND/4	4	ND	ND
Arsenic	ND/[4.5]	20	ND	ND	ND/15	15	ND	ND
Barium	[27]	1,730	27	102	150	1,070	ND/[92]	180
Beryllium	ND/[.36]	[3.9]	ND/0.6	0.6	ND	ND	ND	ND
Cadmium	ND/2.9	27	1.3 c	2.3	ND	ND	ND	ND
Calcium	[2,500]*	1,260,000	N/A	N/A	70,240 E	161,100 E	N/A	N/A
Chromium	9.6	145*	4	13	ND/11	144	ND/15	15
Cobalt	[3.4]	[51]	ND/5.3	5.3	ND/80	80	ND	ND
Copper	[13]	167	7	23	ND/[16]	106	ND/[18]	[18]
Iron	11,900	147,000	8,598	18,696	[51]	105,000	[77]	4,460
Lead	4.5	432*	6.8	31.3	ND/6.5	102	ND	ND
Magnesium	[2,060]*	292,000	N/A	N/A	29,780 E	131,800 E	N/A	N/A

TABLE 1-1

SUMMARY OF REMEDIAL INVESTIGATION DATA[1]
ECC SITE

Parameter	Soil[2]		Sediments		Subsurface Water		Offsite Surface Water	
	Minimum[3]	Maximum[3]	Minimum[3]	Maximum[3]	Minimum (μg/l)	Maximum (μg/l)	Minimum (μg/l)	Maximum (μg/l)
Manganese	158	6,870	161	499	ND/17	1,930	76	1,708
Mercury	ND	ND	ND/0.05	2.25	ND/0.2	0.4	ND/0.2 b	0.4 b
Nickel	[5.8]	37	ND/13	23	ND/[32]	176	ND/[21]	47
Potassium	ND/[905]	[10,500]	N/A	N/A	ND/[1195]	105,940	N/A	N/A
Selenium	ND	ND	ND	ND	ND/3	4	ND/6	6
Silver	ND/[3.3]	[3.8]	ND	ND	ND/14	33	ND/[9.2]	9.2
Sodium	ND/[480]	[15,600]	N/A	N/A	10,060	380,700	N/A	N/A
Thallium	ND	ND	ND	ND	ND/0.4	0.4	ND	ND
Tin	ND/17	30	ND	ND	ND	ND	ND	ND
Vanadium	[15]	37	ND/23	23	ND	ND	ND	ND
Zinc	[38]	650*	ND/52	75	ND/11	276	ND/36 B	79 B
Cyanide	ND/0.8	4.4	ND/33	73	ND	ND	ND/0.005	0.013

Notes

(1) These data were obtained from the tables of analytical results presented in Section 4.0 of the RI Report by CH2M Hill, dated March 14, 1986.

(2) The ranges given for soil are taken from the Phase II data only, since some soil was removed from the site after the Phase I analyses.

(3) The units for the soil and sediment analyses are: μg/kg for volatiles, acid extractables, base neutrals, and PCBs/pesticides results; and mg/kg for the inorganics results.

Key

*	The duplicate analysis was not within control limits.
[]	The value was less than the Contract Required Detection Limit.
B	The analyte was found in the laboratory blank and in the sample, which indicates probable contamination.
C	The identification of this polychlorinated biphenyl (PCB)/pesticide parameter has not been confirmed by gas chromatography/mass spectrometry (GC/MS).
J	The value is estimated and occurs when the mass spectra data indicate the presence of a compound that meets the identification criteria and the result is less than the specified detection limit but greater than zero.
E	The value is estimated or not reported because of the presence of interferences.
K	The actual value, within the limits of the method, is less than the value given.
a	There was a poor or marginal recovery of this spiked metal.
b	This metal was also detected in the analysis of the field blank.
c	This value should be regarded as a qualitative indication of the presence of these metals because the concentration is below the lowest quantitative standard.
d	An estimated value.
e	The Quality Assurance (QA) review identified the results as semiquantitative because the average surrogate recovery was <40 percent.
ND	The compound was not detected. A number after ND in the "Minimum" column is the lowest detected concentration of the compound. For example, "ND/6" means that the compound was not detected in some samples and that the lowest detected concentration was 6.
N/A	The compound was not analyzed for.
	A blank space in the table indicates that no analytical results were given in the Remedial Investigation Report for that compound in that matrix. The compound was either not analyzed for or not detected.

1.3 Remedial Action Objectives

The objectives of the remediation activities at the ECC Site are to:

- Extract, concentrate, and destroy organic compounds by using an in-situ SVE system.
- Enhance the operation of the SVE system and minimize the migration of the compounds remaining in the soils by installing a low permeability final cover.
- Monitor the effectiveness of the remediation activities by collecting subsurface and surface water, soil, and vapor samples.

1.4 Sample Network Design and Rationale

The sample network design and rationale are presented in Section 4.0 of the Remedial Action FSP. With the exception of the background water samples, the sampling locations and frequency for all media to be sampled during the remediation activities (extracted soil vapor, soil, and subsurface and surface water) are specified in Exhibit A to the Consent Decree.

7.

1.5 Parameters To Be Tested and Frequency

Table 1-2 presents a summary of the investigative and QC samples to be collected. Table 1-3 through 1-6 indicate the parameters to be analyzed in each sampling matrix and the Acceptable Concentrations in each medium as defined in Exhibit A to the Consent Decree.

TABLE 1-2

SUMMARY AND QUALITY CONTROL SAMPLES TO BE COLLECTED
ECC SITE
PAGE 1 OF 6

Sample Matrix	Field Parameters	Laboratory Parameters[1]	Compliance Samples[2]			Field QA/QC Samples[3]									Total
						Field Duplicate			Field Blank			MS/MSD[4,5]			
			No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	
Combined Extracted Soil Vapor	--	Volatiles	1	26	26	--	--	--	--	--	--	--	--	--	26
		Phenol	1	26	26	--	--	--	--	--	--	--	--	--	26
Individual Extraction Trenches Soil Vapor	--	Volatiles	28	4	112	--	--	--	3	4	12	--	--	--	124
		Phenol	28	4	112	--	--	--	3	4	12	--	--	--	124
Soil Performance Monitoring	--	Volatiles	20	1	20	2	1	2	--	--	--	1	1	1	23
		Phenol	20	1	20	2	1	2	--	--	--	1	1	1	23
Initial Performance Monitoring - Onsite Subsurface Water[6,7]	pH Specific Conductance Temperature	1,1-DCA	4	1	4	1	1	1	1	1	1	1	1	1	7
		Other Volatiles	4	1	4	--	--	--	--	--	--	--	--	--	4
		BNAs	4	1	4	--	--	--	--	--	--	--	--	--	4
		PCBs	4	1	4	--	--	--	--	--	--	--	--	--	4
		Chromium VI	4	1	4	--	--	--	--	--	--	--	--	--	4
		Tin	4	1	4	1	1	1	1	1	1	--	--	--	6
		Antimony	4	1	4	1	1	1	1	1	1	--	--	--	6
		Other Metals	4	1	4	--	--	--	--	--	--	--	--	--	4
		Cyanide	4	1	4	--	--	--	--	--	--	--	--	--	4
Quarterly Performance Monitoring (1st Year) - Onsite Subsurface Water[6,7]	pH Specific Conductance Temperature	1,1-DCA	4	4	16	1	4	4	1	4	4	1	4	4	28
		Other Volatiles	4	4	16	--	--	--	--	--	--	--	--	--	16
		BNAs	4	4	16	--	--	--	--	--	--	--	--	--	16
		PCBs	4	4	16	--	--	--	--	--	--	--	--	--	16
		Chromium VI	4	4	16	--	--	--	--	--	--	--	--	--	16
		Tin	4	4	16	1	4	4	1	4	4	--	--	--	24
		Antimony	4	4	16	1	4	4	1	4	4	--	--	--	24
		Other Metals	4	4	16	--	--	--	--	--	--	--	--	--	16
		Cyanide	4	4	16	--	--	--	--	--	--	--	--	--	16

7. Field Q.C.

TABLE 1-2

SUMMARY AND QUALITY CONTROL SAMPLES TO BE COLLECTED
ECC SITE
PAGE 2 OF 6

Sample Matrix	Field Parameters	Laboratory Parameters[1]	Compliance Samples[2]			Field QA/QC Samples[3]: Field Duplicate			Field QA/QC Samples[3]: Field Blanks			Field QA/QC Samples[3]: MS/MSD[4,5]			Total
			No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	
Semiannual Post-Remediation (7 years) Performance Monitoring - Onsite Subsurface Water[6,7]	pH Specific Conductance Temperature	1,1-DCA	4	14	56	1	14	14	1	14	14	1	14	14	98
		Other Volatiles	4	14	56	--	--	--	--	--	--	--	--	--	56
		BNAs	4	14	56	--	--	--	--	--	--	--	--	--	56
		PCBs	4	14	56	--	--	--	--	--	--	--	--	--	56
		Chromium VI	4	14	56	--	--	--	--	--	--	--	--	--	56
		Tin	4	14	56	1	14	14	1	14	14	--	--	--	84
		Antimony	4	14	56	1	14	14	1	14	14	--	--	--	84
		Other Metals	4	14	56	--	--	--	--	--	--	--	--	--	56
		Cyanide	4	14	56	--	--	--	--	--	--	--	--	--	56
Initial Performance Monitoring - Offsite Subsurface Water[7,8]	pH Specific Conductance Temperature	1,1-DCA[10]	4	1	4	--	--	--	--	--	--	--	--	--	4
		Other Volatiles	13	1	13	2	1	2	2	1	2	2	1	2	19
		BNAs	13	1	13	2	1	2	2	1	2	2	1	2	19
		PCBs	13	1	13	2	1	2	2	1	2	2	1	2	19
		Chromium VI	13	1	13	2	1	2	2	1	2	--	--	--	17
		Tin[10]	4	1	4	--	--	--	--	--	--	--	--	--	4
		Arsenic	13	1	13	2	1	2	2	1	2	--	--	--	17
		Antimony[11]	4	1	4	--	--	--	--	--	--	--	--	--	4
		Other Metals	13	1	13	2	1	2	2	1	2	--	--	--	17
		Cyanide	13	1	13	2	1	2	2	1	2	--	--	--	17
Quarterly Performance Monitoring - Offsite Subsurface Water (1st Year)[7,8]	pH Specific Conductance Temperature	1,1-DCA[10]	8	4	32	--	--	--	--	--	--	--	--	--	32
		Other Volatiles	13	4	52	2	4	8	2	4	8	2	4	8	76
		BNAs	13	4	52	2	4	8	2	4	8	2	4	8	76
		PCBs	13	4	52	2	4	8	2	4	8	2	4	8	76
		Chromium VI	13	4	52	2	4	8	2	4	8	--	--	--	68
		Tin[11]	8	4	32	--	--	--	--	--	--	--	--	--	32
		Arsenic	13	4	52	2	4	8	2	4	8	--	--	--	68
		Antimony[10]	8	4	32	--	--	--	--	--	--	--	--	--	32
		Other Metals	13	4	52	2	4	8	2	4	8	--	--	--	68
		Cyanide	13	4	52	2	4	8	2	4	8	--	--	--	68

TABLE 1-2

SUMMARY AND QUALITY CONTROL SAMPLES TO BE COLLECTED
ECC SITE
PAGE 3 OF 6

Sample Matrix	Field Parameters	Laboratory Parameters[1]	Compliance Samples[2]			Field QA/QC Samples[3]: Field Duplicate			Field QA/QC Samples[3]: Field Blanks			Field QA/QC Samples[3]: MS/MSD[4,5]			Total
			No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	
Additional Background Samples Taken in First Year - Offsite Subsurface Water[7,9]	pH	1,1-DCA	4	1	4	1	1	1	1	1	1	1	1	1	7
	Specific Conductance	Other Volatiles	4	1	4	1	1	1	1	1	1	1	1	1	7
	Temperature	BNAs	4	1	4	1	1	1	1	1	1	1	1	1	7
		PCBs	4	1	4	1	1	1	1	1	1	1	1	1	7
		Chromium VI	4	1	4	1	1	1	1	1	1	--	--	--	6
		Tin	4	1	4	1	1	1	1	1	1	--	--	--	6
		Arsenic	4	1	4	1	1	1	1	1	1	--	--	--	6
		Antimony	4	1	4	1	1	1	1	1	1	--	--	--	6
		Other Metals	4	1	4	1	1	1	1	1	1	--	--	--	6
		Cyanide	4	1	4	1	1	1	1	1	1	--	--	--	6
Semiannual Post-Remediation (7 years) Performance Monitoring - Offsite Subsurface Water[7,8]	*pH*	1,1-DCA[11]	--	--	--	--	--	--	--	--	--	--	--	--	--
	Specific Conductance	Other Volatiles	13	14	182	2	14	28	2	14	28	2	14	28	266
	Temperature	BNAs	13	14	182	2	14	28	2	14	28	2	14	28	266
		PCBs	13	14	182	2	14	28	2	14	28	2	14	28	266
		Chromium VI	13	14	182	2	14	28	2	14	28	--	--	--	238
		Tin[11]	--	--	--	--	--	--	--	--	--	--	--	--	--
		Arsenic	13	14	182	2	14	28	2	14	28	--	--	--	238
		Antimony[11]	--	--	--	--	--	--	--	--	--	--	--	--	--
		Other Metals	13	14	182	2	14	28	2	14	28	--	--	--	238
		Cyanide	13	14	182	2	14	28	2	14	28	--	--	--	238
Initial Performance Monitoring Upstream Surface Water Locations (Background)[6,9]	pH	Volatiles	2	1	2	--	--	--	--	--	--	--	--	--	2
	Specific Conductance	BNAs	2	1	2	--	--	--	--	--	--	--	--	--	2
	Temperature	PCBs	2	1	2	--	--	--	--	--	--	--	--	--	2
		Chromium VI	2	1	2	--	--	--	--	--	--	--	--	--	2
		Arsenic	2	1	2	--	--	--	--	--	--	--	--	--	2
		Other Metals	2	1	2	--	--	--	--	--	--	--	--	--	2
		Cyanide	2	1	2	--	--	--	--	--	--	--	--	--	2

TABLE 1-2

SUMMARY AND QUALITY CONTROL SAMPLES TO BE COLLECTED
ECC SITE
PAGE 4 OF 6

Sample Matrix	Field Parameters	Laboratory Parameters[1]	Compliance Samples[2]			Field QA/QC Samples[3] Field Duplicate			Field QA/QC Samples[3] Field Blanks			Field QA/QC Samples[3] MS/MSD[4,5]			Total
			No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	
Quarterly Performance Monitoring (1st Year) Upstream Surface Water Locations (Background)	pH	Volatiles	2	4	8	1	4	4	1	4	4	1	4	4	20
	Specific Conductance	BNAs	2	4	8	1	4	4	1	4	4	1	4	4	20
	Temperature	PCBs	2	4	8	1	4	4	1	4	4	1	4	4	20
		Chromium VI	2	4	8	1	4	4	1	4	4	--	--	--	16
		Arsenic	2	4	8	1	4	4	1	4	4	--	--	--	16
		Other Metals	2	4	8	1	4	4	1	4	4	--	--	--	16
		Cyanide	2	4	8	1	4	4	1	4	4	--	--	--	16
Additional Background Samples Taken in 1st Year - Upstream Surface Water Locations[9]	pH	Volatiles	2	1	2	--	--	--	--	--	--	--	--	--	2
	Specific Conductance	BNAs	2	1	2	--	--	--	--	--	--	--	--	--	2
	Temperature	PCBs	2	1	2	--	--	--	--	--	--	--	--	--	2
		Chromium VI	2	1	2	--	--	--	--	--	--	--	--	--	2
		Arsenic	2	1	2	--	--	--	--	--	--	--	--	--	2
		Other Metals	2	1	2	--	--	--	--	--	--	--	--	--	2
		Cyanide	2	1	2	--	--	--	--	--	--	--	--	--	2
Semi-Annual Post Remediation (7 Years) Performance Monitoring Upstream Surface Water Locations	pH	Volatiles	2	14	28	1	14	14	1	14	14	1	14	14	70
	Specific Conductance	BNAs	2	14	28	1	14	14	1	14	14	1	14	14	70
	Temperature	PCBs	2	14	28	1	14	14	1	14	14	1	14	14	70
		Chromium VI	2	14	28	1	14	14	1	14	14	--	--	--	56
		Arsenic	2	14	28	1	14	14	1	14	14	--	--	--	56
		Other Metals	2	14	28	1	14	14	1	14	14	--	--	--	56
		Cyanide	2	14	28	1	14	14	1	14	14	--	--	--	56
Initial Performance Monitoring Downstream Sample Location	pH	Volatiles	1	1	1	1	1	1	1	1	1	1	1	1	4
	Specific Conductance	BNAs	1	1	1	1	1	1	1	1	1	1	1	1	4
	Temperature	PCBs	1	1	1	1	1	1	1	1	1	1	1	1	4
		Chromium VI	1	1	1	1	1	1	1	1	1	--	--	--	3
		Arsenic	1	1	1	1	1	1	1	1	1	--	--	--	3
		Other Metals	1	1	1	1	1	1	1	1	1	--	--	--	3
		Cyanide	1	1	1	1	1	1	1	1	1	--	--	--	3

TABLE 1-2

SUMMARY AND QUALITY CONTROL SAMPLES TO BE COLLECTED
ECC SITE

						Field QA/QC Samples[3]									
			Compliance Samples[2]			Field Duplicate			Field Blanks			MS/MSD[4,5]			
Sample Matrix	Field Parameters	Laboratory Parameters[1]	No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	No.	Freq.	Total	Total
Quarterly Performance Monitoring (1st Year) Downstream Surface Water Location	pH Specific Conductance Temperature	Volatiles	1	4	4	1	4	4	1	4	4	1	4	4	16
		BNAs	1	4	4	1	4	4	1	4	4	1	4	4	16
		PCBs	1	4	4	1	4	4	1	4	4	1	4	4	16
		Chromium VI	1	4	4	1	4	4	1	4	4	--	--	--	12
		Arsenic	1	4	4	1	4	4	1	4	4	--	--	--	12
		Other Metals	1	4	4	1	4	4	1	4	4	--	--	--	12
		Cyanide	1	4	4	1	4	4	1	4	4	--	--	--	12
Semi-Annual Post Remediation (7 Years) Downstream Surface Water Location	pH Specific Conductance Temperature	Volatiles	1	14	14	1	14	14	1	14	14	1	14	14	56
		BNAs	1	14	14	1	14	14	1	14	14	1	14	14	56
		PCBs	1	14	14	1	14	14	1	14	14	1	14	14	56
		Chromium VI	1	14	14	1	14	14	1	14	14	--	--	--	42
		Arsenic	1	14	14	1	14	14	1	14	14	--	--	--	42
		Other Metals	1	14	14	1	14	14	1	14	14	--	--	--	42
		Cyanide	1	14	14	1	14	14	1	14	14	--	--	--	42

<u>Key</u>

1,1-DCA = 1,1-Dichloroethane
BNAs = Base Neutral/Acids
PCBs = Polychlorinated Biphenyls

TABLE 1-2
SUMMARY AND QUALITY CONTROL SAMPLES TO BE COLLECTED
ECC SITE
PAGE 6 OF 6

Notes

(1) See Tables 4-1, 4-3, 4-4, and 4-5 of the FSP for the specific analytical parameters to be analyzed for each matrix.

(2) The number of compliance samples depends on the duration of the SVE system operation. The numbers shown assume 1 year of operation and 7 years of post remediation onsite and offsite monitoring. See Section 4.0 of the FSP for a description of the frequency of sample collection per matrix.

(3) The field Quality Assurance/Quality Control (QA/QC) samples also include trip blanks, which are required for volatile organics samples. One trip blank, consisting of two 40-ml glass vials filled with organic-free, deionized water, will be included with each shipping container of volatile organic samples. The media used for field blanks is organic-free, deionized water. Trip blanks for the extraction trench vapor sampling for VOC analysis will consist of one unbroken sampling tube per shipment.

NO.

(4) The matrix spike/matrix spike duplicate (MS/MSD) is required only for 1,1-DCA analysis on water samples. Triple the normal sample volume will be collected for 1,1-DCA analysis. The rest of the parameters will be analyzed using the CLP SOW OLC01.0, which does not require collection of MS/MSD samples.

(5) For inorganics, organics in soil, and soil vapor analyses, no extra sample volume is required.

(6) Sampling of all subsurface and surface water will be conducted simultaneously. With the exception of the 1,1-DCA and tin analyses, for which the QA/QC samples are included with the onsite subsurface water samples, the field duplicate and blank samples for this matrix are included in the number of QA/QC samples shown for offsite subsurface water sampling.

(7) Subsurface samples for inorganics and PCBs analyses will be filtered.

(8) The MS/MSD sample for 1,1-DCA analysis is included with the onsite subsurface water samples.

(9) Since the collection of additional subsurface and surface water background samples will coincide, the QA/QC samples identified for the subsurface water from the additional background samples taken in the first year will cover all of the background subsurface and surface water samples.

(10) For 1,1-DCA, tin, and antimony, only the background sample will be analyzed for these parameters.

(11) Analysis for these parameters is only required for background samples and is discontinued after the first year.

TABLE 1-3 SOIL VAPOR CONCENTRATIONS IN EQUILIBRIUM WITH ACCEPTABLE SOIL CONCENTRATIONS ECC SITE	
Parameter[1]	Soil Vapor Concentration[2] (ppm by volume)
Volatile Organics:	
Acetone	254
Chloroform	496
1,1-Dichloroethane	3.4
1,1-Dichloroethene	515
Ethyl Benzene	9,316
Methylene Chloride	22.4
Methyl Ethyl Ketone	13
Methyl Isobutyl Ketone	233
Tetrachloroethene	16.8
Toluene	36,556
1,1,1-Trichloroethane	2,819
1,1,2-Trichloroethane	1.1
Trichloroethene	71.5
Total Xylenes	4,794
Base Neutral/Acid Organics:	
Phenol	1.4

Notes

(1) Compounds detected in the soils at least once during the Remedial Investigation at concentrations above the Acceptable Soil Concentrations listed in Table 3-1 of Exhibit A to the Consent Decree.

(2) From Table 4-1 of Exhibit A to the Consent Decree.

TABLE 1-4 ACCEPTABLE SOIL CONCENTRATIONS[1] ECC SITE	
Parameter	**Acceptable Soil Concentration (μg/kg)**
Volatile Organics:	
Acetone	490
Chlorobenzene	10,100
Chloroform	2,300
1,1-Dichloroethane	5.7
1,1-Dichloroethene	120
Ethyl Benzene	234,000
Methylene Chloride	20
Methyl Ethyl Ketone	75
Methyl Isobutyl Ketone	8,900
Tetrachloroethene	130
Toluene	238,000
1,1,1-Trichloroethane	7,200
1,1,2-Trichloroethane	22
Trichloroethene	240
Total Xylenes	195,000
Base Neutral/Acid Organics:	
Phenol	9,800

<u>Notes</u>

[1] From Table 3-1 of Exhibit A to the Consent Decree.

TABLE 1-5

ONSITE TILL WATER
ACCEPTABLE SUBSURFACE WATER CONCENTRATIONS[1]
ECC SITE
PAGE 1 OF 2

Parameter		Acceptable Subsurface Water Concentration[1] (μg/L)
Volatile Organics:	OLC-M.	
Acetone		3,500
Chlorobenzene		60
Chloroform		100
1,1-Dichloroethane	1	0.38
1,1-Dichloroethene		7
Ethyl Benzene		680
Methylene Chloride		4.7
Methyl Ethyl Ketone		170
Methyl Isobutyl Ketone		1,750
Tetrachloroethene	1	0.69
Toluene		2,000
1,1,1-Trichloroethane		200
1,1,2-Trichloroethane	1	0.61
Trichloroethene		5
Total Xylenes		440
Base Neutral/Acid Organics:	OLM-M.	
Bis(2-ethylhexyl)phthalate	10	2.5
Di-n-butyl Phthalate		3,500
Diethyl Phthalate		28,000
Isophorone	10	8.5
Naphthalene		14,000
Phenol		1,400

TABLE 1-5 ONSITE TILL WATER ACCEPTABLE SUBSURFACE WATER CONCENTRATIONS[1] ECC SITE PAGE 2 OF 2	
Parameter	Acceptable Subsurface Water Concentration[1] (μg/L)
Inorganics[2]:	
Antimony	14
Arsenic	50
Barium	1,000
Beryllium	175
Cadmium	10
Chromium VI	50
Lead	50
Manganese	7,000
Nickel	150
Silver	50
Tin	21,000
Vanadium	245
Zinc	7,000 — TMM-M
Cyanide	~~10~~ 154
Polychlorinated Biphenyls (PCBs)[2]:	.20+.40 0.0045[3] OLCO-M.

Notes

[1] From Table 3-1 of Exhibit A to the Consent Decree.

[2] Dissolved, except for cyanide.

[3] The Acceptable Subsurface Water Concentration shown is for the sum of all PCBs present.

TABLE 1-6

OFFSITE SUBSURFACE WATER AND SURFACE WATER ACCEPTABLE STREAM CONCENTRATIONS[1] ECC SITE

Parameter	Acceptable Stream Concentration[1] (μg/L)
Volatile Organics:	OLC-M.
Chloroform	15.7
1,1-Dichloroethene	1.9
Ethyl Benzene	3,280
Methylene Chloride	15.7
Tetrachloroethene	8.9
Toluene	3,400
1,1,1-Trichloroethane	5,280
1,1,2-Trichloroethane	41.8
Trichloroethene	80.7
Base Neutral/Acid Organics:	OLMO-M
Bis(2-ethylhexyl)phthalate	50,000
Di-n-butyl Phthalate	154,000
Diethyl Phthalate	52,100
Naphthalene	620
Phenol	570
Inorganics[2]:	ICM
Arsenic	0.0175
Chromium VI	11
Lead	10
Nickel	100
Zinc	47
Cyanide	10 5.2
Polychlorinated Biphenyls (PCBs)[2]:	204.40 0.000079[3] OLC-M.

<u>Notes</u>

(1) From Table 3-1 of Exhibit A to the Consent Decree.

(2) Dissolved (except for cyanide) for subsurface water.

(3) The Acceptable Stream Concentration shown is for the sum of all PCBs present.

1.6 Data Quality Objectives and Intended Data Uses

DQOs are qualitative and quantitative statements defined by U.S. EPA that specify the quality of the data required to support decisions made during site remediation activities and are based on the end uses of the data to be collected. As such, different data uses may require different levels of data quality. There are five analytical levels that address various data uses and the QA/QC efforts and methods required to achieve the desired level of quality. These levels are:

- Screening (DQO Level 1): This provides the lowest data quality but the most rapid results. It is often used for health and safety monitoring at a Site, preliminary comparison of site data to Applicable or Relevant and Appropriate Requirements (ARARs), initial site characterization to locate areas that require subsequent and more accurate analyses, and engineering screening of alternatives (bench-scale tests).

- Field Analyses (DQO Level 2): This provides rapid results and better quality than Level 1 analyses. This level may include mobile laboratory-generated data depending on the level of quality control exercised.

- Engineering (DQO Level 3): This provides an intermediate level of data quality and is used for site characterization. Engineering analyses may include mobile laboratory-generated data and some analytical laboratory methods (e.g., laboratory data with quick turnaround used for screening but without full QC documentation).

- Conformational (DQO Level 4): This provides the highest level of data quality and is used for the purposes of conducting a risk assessment, evaluating remedial alternatives, and determining the Potentially Responsible Parties. These analyses require full Contract Laboratory Program (CLP) analytical methods and data validation procedures in accordance with U.S. EPA-recognized protocols.

- Nonstandard (DQO Level 5): This refers to analyses by nonstandard protocols, for example, when exact detection limits or the analysis of an unusual chemical compound is required. These analyses often require method development or adaptation. The level of quality control is usually similar to DQO Level 4 data.

The primary data uses for the ECC Site sampling are to assess the effectiveness of the remediation activities; however, some of the data will be used for health and safety purposes (i.e., to establish the level of protection needed for water sampling activities at the Site). Table 1-7 provides a summary of the DQOs and intended data uses for each sample type to be collected at the Site.

TABLE 1-7

DATA QUALITY OBJECTIVES AND INTENDED DATA USES
ECC SITE
PAGE 1 OF 2

Data Collected	Data Quality Objective[1]	Intended Data Use
Combined Extracted Soil Vapor - Volatile Organics - Phenol	 Level V Level V	Demonstrate compliance with the Soil Vapor Criterion for Soil Cleanup Verification, as specified in Section 4.2 of Exhibit A to the Consent Decree.
Individual Extraction Trenches Soil Vapor - Volatile Organics - Phenol	 Level V Level V	Evaluate the completeness of vapor extraction activities and determine the time for initiation of the "restart spikes," as specified in Section 4.2 of Exhibit A to the Consent Decree.
Soil Samples - Volatile Organics - Phenol	 Level V Level IV	Demonstrate compliance with the Soil Sample Criterion for Soil Cleanup Verification, as specified in Exhibit A to the Consent Decree.
Onsite Subsurface Water - CLP Parameters[2] - 1,1-DCA - Tin - Cr VI - Antimony	 Level IV Level V Level V Level V Level V	(1) Demonstrate compliance with the Onsite Till Water Criterion for Soil Cleanup Verification, as specified in Section 4.2 of Exhibit A to the Consent Decree; and (2) demonstrate the effectiveness of the remediation activities to minimize migration of parameters remaining in the soil after the soil vapor extraction is completed.
Offsite Subsurface Water - CLP Parameters[2] - 1,1-DCA - Tin - Cr VI - Arsenic - Antimony	 Level IV Level V Level V Level V Level V Level V	(1) Demonstrate the effectiveness of the remediation activities to minimize migration of parameters remaining in the soil after the soil vapor extraction is completed; and (2) determine the "Applicable Subsurface Water Background Concentrations," as described in Footnote 2 of Table 3-1 of Exhibit A to the Consent Decree.
Surface Water - CLP Parameters[2] - Cr VI - Arsenic	 Level IV Level V Level V	(1) Demonstrate the effectiveness of the remediation activities to minimize migration of parameters remaining in the soil after soil vapor extraction is completed; and (2) determine the "Applicable Surface Water Background Concentrations," as described in Footnote 4 of Table 3-1 of Exhibit A to the Consent Decree.
Additional Offsite Background Subsurface Water from Investigative Upgradient Wells - CLP Parameters[2] - 1,1-DCA - Tin - Cr VI - Antimony	 Level IV Level V Level V Level V Level V	Determine the "Applicable Subsurface Water Background Concentrations," as described in Footnote 2 of Table 3-1 of Exhibit A to the Consent Decree.
Additional Background Surface Water from Investigative Upstream Location - CLP Parameters[2] - Cr VI - Arsenic	 Level IV Level V Level V	Determine the "Applicable Surface Water Background Concentrations," as described in Footnote 4 of Table 3-1 of Exhibit A to the Consent Decree.

TABLE 1-7

DATA QUALITY OBJECTIVES AND INTENDED DATA USES
ECC SITE
PAGE 2 OF 2

Data Collected	Data Quality Objective[1]	Intended Data Use
Subsurface Water from Background-Only Wells - CLP Parameters[2] - 1,1-DCA - Tin - Cr VI - Antimony	 Level IV Level V Level V Level V Level V	Determine the "Applicable Subsurface Water Background Concentrations," as described in Footnote 2 of Table 3-1 of Exhibit A to the Consent Decree.
Surface Water from Background-Only Location - CLP Parameters[2] - Cr VI - Arsenic	 Level IV Level V Level V	Determine the "Applicable Surface Water Background Concentrations," as described in Footnote 4 of Table 3-1 of Exhibit A to the Consent Decree.
Subsurface Water - Water Level	 Level I	Predict ground water flow rates and direction to assist in prediction of parameter migration velocity and direction.
Field Water Data - Temperature - pH - Specific Conductance	 Level II Level II Level II	Determine whether subsurface water has stabilized in the monitoring wells, to provide a comparison with previous samplings and to aid in characterizing the water quality.
Field Ambient Air - Organics Vapors	 Level IV	Determine the level of respiratory protection required during sampling activities at the site and ensure that offsite migration of contaminants does not occur during construction activities.

Notes

(1) Based on "Data Quality Objectives for Remedial Response Activities" - EPA 540/6-87/003, March 1987.

(2) Only the parameters shown in Table 1-3 through 1-6 which are not otherwise listed on this table will be analyzed using the CLP protocols as modified on Appendix A.8.

Key

1,1-DCA	=	1,1-Dichloroethane
Cr VI	=	Chromium VI
CLP	=	Contract Laboratory Program protocols
QAPP	=	Quality Assurance Project Plan

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The U.S. EPA and IDEM will be responsible for the government reviews associated with this Remedial Action. The ECC Trust will have the overall responsibility for implementing the Remedial Action at the Site. The Remedial Design Engineer is responsible for the preparation of the remedial design, the FSP, QAPP, and the CQAP for the SPMR activities, as well as the HSP. The Remedial Contractor(s) will prepare a Construction Quality Control (CQC) Plan for the construction activities based on the requirements of the CQAP.

The various QA and management responsibilities of key project personnel associated with environmental sampling and analyses are defined in the following subsections. A project organization chart, which includes the lines of authority, is included as Figure 2-1.

2.1 ECC Trust

The ECC Trust will have the overall responsibility for the implementation of the Remedial Action at the ECC Site. The ECC Trust and/or their designated ECC Trust's Engineer (Engineer) have the authority to commit the resources necessary to meet the project objectives and requirements.

The ECC Trust will: (1) provide the major point of contact with the U.S. EPA and IDEM for matters concerning the project; (2) ensure that the project activities meet the requirements of the Consent Decree; and (3) approve all external reports (deliverables) before their submission to the agencies.

2.2 U.S. EPA Remedial Project Manager

The U.S. EPA Remedial Project Manager (RPM), will be responsible for overseeing the project and coordinating the U.S. EPA and IDEM's review and approval of remedial design and associated plans for the remediation activities.

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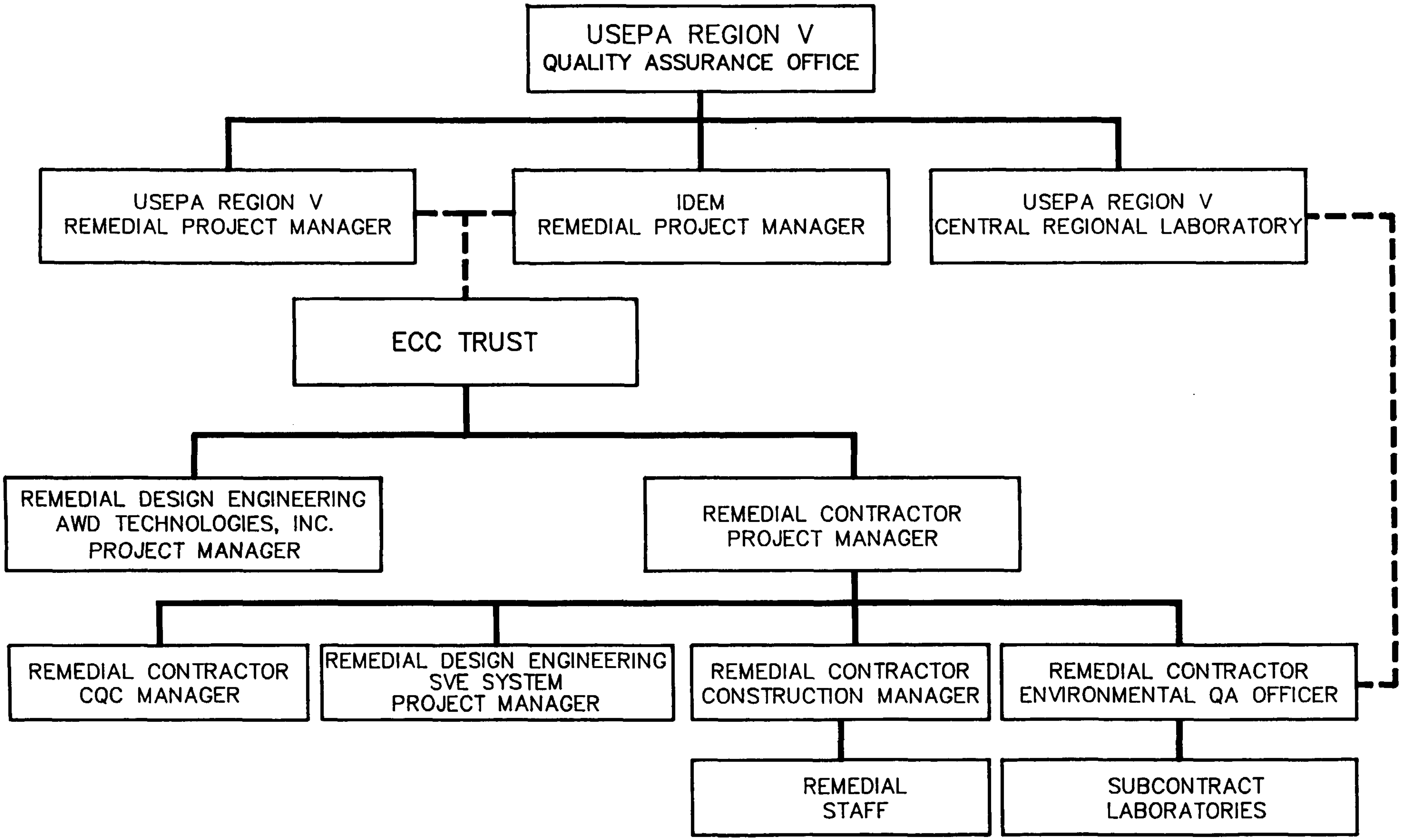

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AWD TECHNOLOGIES, INC

AWD TECHNOLOGIES

QUALITY ASSURANCE ORGANIZATION
REMEDIAL ACTIVITIES

ENVIRO-CHEM SUPERFUND SITE ZIONSVILLE, IN

CLIENT: ENVIRONMENTAL CONSERVATION & CHEMICAL CORP. TRUST | JOB NO. 2259-502

SCALE: NONE | FIGURE NUMBER 2-1 | REV 0

2.3 IDEM Remedial Project Manager

The IDEM RPM will be responsible for overseeing the project and for conducting all IDEM reviews of the remedial design and associated plans.

2.4 Remedial Design Engineering Project Managers

Design Engineering for the Remedial Action will be performed in two stages. The first stage involves the design of the final cover and compliance monitoring systems and preparation of a SVE system performance specification. This design stage is presently being undertaken by AWD Technologies, Inc. The second stage involves detailed design of the SVE system. This design will be performed by the Remedial Contractor and will require approval by the Engineer and the U.S. EPA prior to construction. Each design stage will have a Project Manager.

The Design Engineering Project Managers have the responsibility to provide a design which is capable of fulfilling the construction efforts as set forth in the Remedial Action Plan. Unexpected site conditions or changes in construction methodology could occur requiring design changes, therefore, the Design Engineering Project Managers may be active participants in progression of the project construction.

The Design Engineering Project Management staffs will either be part of the Project Manager's technical staff or will be a consulting engineer. They will support the Project Managers in the decision-making process for any required design changes. Any such changes will be fully documented. The Design Engineering Managers will either report to the Engineer or the Remedial Contractor's Project Manager, depending on whether they are in the role of consulting engineer or Remedial Contractor design staff, respectively.

2.5 Remedial Contractor Project Manager

The ECC Trust will select ~~a~~ Remedial Contractor(s) to perform the Remedial Action. The Contractor(s) Project Manager ~~will have the overall~~ responsibility for ensuring that the project meets the U.S. EPA objectives and the quality standards specified in this QAPP and the CQAP.

The Contractor(s) Project Manager will: (1) acquire and apply technical resources as needed to ensure performance within budget and schedule constraints; (2) orient, direct, and monitor all field leaders and support staff; (3) review the work performed on each task to ensure its quality, responsiveness, and timeliness; and (4) be responsible for the preparation and quality of the reports submitted to the agencies.

2.6 Remedial Contractor Construction Manager

The Construction Manager will be responsible for leading and coordinating the day-to-day activities of the various workers and subcontractors under their supervision. The Construction Manager will be a highly experienced environmental professional and will report directly to the Project Manager. Specific responsibilities will include: (1) implementation of field-related work plans; (2) assurance of schedule compliance; (3) coordination and management of field staff; (4) compliance with QA/QC requirements described in this QAPP; (5) compliance with the corrective action procedures described in this QAPP; and (6) participation in the preparation of the final report.

2.7 Remedial Contractor Technical Staff

The technical staff for this project will be drawn from the Remedial Contractors' pool of resources. The technical staff team will perform field tasks, analyze the data, and prepare the reports.

2.8 Remedial Contractor Environmental Quality Assurance Officers

The Environmental QA Officer (QAO) for the remedial and sampling activities at the Site will have the overall responsibility for the Remedial Contractors' compliance with the QA requirements of this plan. The QAO will review and approve all reports and corrective actions related to the Site; perform audits of the field activities and records; confirm subcontracted laboratory QA compliance, provide QA technical assistance to the remedial and technical staff; oversee data validation of analytical data including tentatively identified compounds (TICs); and report on the adequacy, status, and effectiveness of the QA program on a regular basis to the Contractor Project Manager.

The QAO will also be responsible for validation of analytical data reports on all sampling conducted under the Remedial Action. A letter validation report shall be developed which contains a discussion on the results of the QA samples collected in the field and the laboratory's internal QA analyses. The report should summarize the findings of the review and give an indication of the general quality of the data.

2.9 U.S. EPA Region V Quality Assurance Officer

The U.S. EPA Region V QAO will have the responsibility of reviewing and approving all QAPPs.

2.10 Subcontract Laboratories' Project Managers

The analyses to be performed by laboratory subcontractors are listed in Table 7-1. The laboratories will be selected by the Remedial Contractor and will be approved by the ECC Trust and U.S. EPA/IDEM. The laboratories' Project Managers will be responsible for coordinating and scheduling the laboratory analyses; supervising the in-house chain of custody; accepting requirements outlined within this QAPP; and overseeing the data review and preparation of the analytical reports.

2.11 Subcontract Laboratories' Quality Assurance Officers

The laboratories' QAOs will be responsible for overseeing the laboratory QA and the analytical results QA/QC documentation, conducting the data review, selecting any necessary laboratory corrective actions, adherence to applicable in-house SOPs, adherence to the QAPP, and approving the final analytical reports. Each laboratory may have more than one QAO if, for example, any of these various activities take place in different departments within the laboratory.

2.12 U.S. EPA Region V Central Regional Laboratory

The Laboratory Scientific Support Section of the Central Regional Laboratory (CRL) of U.S. EPA Region V will be responsible for external performance and system audits of the analytical laboratories.

2.13 QA Submittals

A list of Quality Assurance submittals and the personnel or organization responsible for preparation of the submittal, the recipient of the submittal, and the schedule of submissions is contained on Table 2-1.

Labs
quals, address, analysis

TABLE 2-1

QA SUBMITTALS
ECC SITE

Submittal	Preparer of Submittal	Recipient of Submittal	Schedule of Submissions
Laboratory Data (Raw)	Analytical Laboratory	Environmental Quality Assurance Officer of Remedial Contractor	28 days from receipt of samples
Validated Data and Validation Report	Environmental Quality Assurance Officer of Remedial Contractor	Remedial Contractor's Project Manager Quality Assurance Officer of U.S. EPA Region V IDEM	14 days from receipt of raw data packages
Field Measurements Logbook	Field Personnel	Remedial Contractor's Project Manager	Upon completion of specified project phase
Sample Collection Data Logbook	Sampling Personnel	Remedial Contractor's Project Manager	Upon completion of specified project phase
Chain of Custodies	Sampling Personnel	Analytical Laboratory (Original) Sampler (Copy) ECC Trust's Engineer (Copy)	Upon receipt of samples
QA Non-Conformances - Laboratory	Laboratory Personnel	Analytical Laboratory's Quality Assurance Officer	Upon occurrence of non-conformance
Corrective Action Request (CAR)	Construction Manager	ECC Trust's Engineer U.S. EPA Project Manager IDEM Project Manager	As necessary
Quality Assurance Report	Environmental QA Officer	ECC Trust's Engineer U.S. EPA Project Manager IDEM Project Manager	28 days after project completion

3.0 QUALITY ASSURANCE OBJECTIVES

The overall QA objective is to develop and implement procedures for sampling, chain of custody, laboratory analyses, field measurements, and reporting that will provide data of a quality consistent with its intended use and defensible in a court of law. Specific procedures for sampling, chain of custody, laboratory and field instrument calibration, laboratory analysis, reporting of data, internal quality control, audits, preventive maintenance of equipment, and corrective action are described in other sections of this QAPP. This section addresses the accuracy, precision, sensitivity, completeness, representativeness, and comparability of analyses.

3.1 Level of Quality Control Effort

Sampling equipment rinsate blanks, trip blank, field duplicate, and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling program. Field and trip blanks consisting of distilled water will be submitted to the analytical laboratories to provide the means of assessing the quality of the data resulting from the field sampling program. Field blank samples are analyzed to check for procedural contamination at the Site that may cause sample contamination. Trip blanks are used to assess the potential for contamination of samples because of contaminant migration during sample shipment and storage. Field duplicate samples are analyzed to check for sampling reproducibility. Matrix spikes (MS) provide information about the effect of the sample matrix on the digestion and measurement methodology. All matrix spikes for organic analyses are performed in duplicate and are hereinafter referred to as MS/MSD samples.

The general level of QC effort will include one field duplicate and one field blank for every 10 or fewer investigative samples. However, no field blanks will be collected for the soil samples, and no duplicates will be collected for the soil vapor samples. One VOC trip blank (consisting of two unopened 40-ml vials filled with distilled, deionized, ultra-pure water) will be included along with each shipment of aqueous VOC samples. Also, one VOC trip blank consisting of an activated charcoal tube will be included with each shipment of vapor VOC samples.

The general level of QC effort will also include one MS/MSD analysis for every 20 or fewer samples. For the water samples designated for MS/MSD analysis, triple the normal volume will be collected for VOC analysis, and double the normal volumes will be collected for samples for BNA and polychlorinated biphenyl (PCBs) analyses. For organics in soil and all inorganics designated for MS/MSD analysis, no extra sample volume is needed. For soil vapor analysis, blank tubes will be used for MS/MSD spiking. The number of MS/MSD, duplicate, and field blank samples to be collected are listed in Table 1-2. Sampling procedures are specified in the FSP.

If only one vapor sample is collected, no field QC sample will be submitted to the laboratory, because the sample is used only for operational control of the system and no laboratory-supplied QC samples (MS/MSD or blank tubes) will be analyzed. Also, no duplicates will be collected from the SVE system, because the sample collection process cannot be exactly duplicated. Since the onsite and offsite subsurface water samples will be collected simultaneously, those samples will be grouped together to determine the number of QA/QC samples needed.

The levels of QC effort by selected analytical laboratories will be detailed in their SOPs. Example levels of QC effort are included in Appendices A, C, and D.

The level of QC effort for the field measurement of pH will consist of a precalibration at the beginning of the day by using two buffer solutions and calibration verification at regular intervals (at least once each day). QC effort for field specific conductance measurements will consist of an initial calibration at the beginning of the day and continuing calibration verification (at least once each day) by using a standard solution of a known specific conductance. Appendices E and F (Volume III) contain detailed procedures for calibration and maintenance of the field equipment.

3.2 Accuracy, Precision, and Sensitivity of Analyses

The QA objectives of laboratory analyses with respect to accuracy, precision, and sensitivity are to achieve the QC acceptance criteria of the analytical protocols. Accuracy and precision requirements for CLP protocol analyses are described in the SOWs OLC01.0, OLM01.0 (with the corresponding revisions), and ILM01.0. Examples of accuracy and precision criteria for tin, 1,1-DCA, volatiles in soil, and antimony and arsenic in water analyses are described in the respective SOPs in Appendices A.1, A.2, A.9, and D.1. Suggested accuracy and precision criteria for vapor analysis are presented in Appendix C. Table 3-1 summarizes the project-required detection limits for each medium sampled.

The QA objectives of field analyses with respect to accuracy, precision, and sensitivity are to achieve acceptable data, based on specified performance criteria. The project-required accuracy and precision of the field instruments are specified on Table 3-2 along with the estimated instrument accuracy and precision capabilities. The accuracy of field measurements of pH will be assessed through premeasurement calibrations and postmeasurement verifications using at least two standard buffer solutions. (The pH meter will be calibrated using two standard buffer solutions, and then the pH of both solutions will be measured.) The two measurements must each be within ± 0.10 pH units of the actual buffer solution values, or the meter will require recalibration. Precision will be assessed through duplicate measurements. (The electrode will be withdrawn, rinsed with deionized water, and reimmersed between each duplicate). The instrument used will be capable of providing measurements to 0.10 standard pH units. The duplicate measurement must be within ± 0.10 pH units of the initial measurement, or the meter will require recalibration.

The accuracy of the specific conductance meter will be assured by daily calibration verification with solutions of known specific conductance. The accuracy of the specific conductance field measurements will be assessed by premeasurement calibration of the specific conductance meter and postmeasurement verification by using solutions of known specific conductance. The measured specific conductance of the standard solution must be within 5 percent of the actual

TABLE 3-1

PROJECT-REQUIRED DETECTION LIMITS
ECC SITE
PAGE 1 OF 3

Laboratory Parameter[2]	Project-Required Detection Limits[1]			
	Soil Vapor[3,4] (Vppm)	Soil[5,6] (μg/kg)	Onsite Till Water (μg/L)	Offsite Subsurface Water and Surface Water (μg/L)
Volatile Organics:				
Acetone	0.35	10	5	N/A
Chlorobenzene	N/A	5	1	N/A
Chloroform	0.46	5	1	1
1,1-Dichloroethane	0.32	5	0.35	N/A
1,1-Dichloroethene	0.30	5	1	1
Ethyl Benzene	0.13	5	1	1
Methylene Chloride	0.63	10	2	2
Methyl Ethyl Ketone	0.30	10	5	N/A
Methyl Isobutyl Ketone	0.22	15	5	N/A
Tetrachloroethene	0.61	5	0.6[8]	0.6
Toluene	0.21	5	1	1
1,1,1-Trichloroethane	0.40	5	1	1
1,1,2-Trichloroethane	0.40	5	0.4[8]	0.4
Trichloroethene	0.45	5	1	1
Total Xylenes	0.20	5	1	N/A
Base Neutral/Acid Organics:				
Bis(2-ethylhexyl)phthalate	N/A	N/A	1.3[8]	10
Di-n-Butyl Phthalate	N/A	N/A	10	10
Diethyl Phthalate	N/A	N/A	10	10
Isophorone	N/A	N/A	1.3[8]	N/A
Naphthalene	N/A	N/A	10	10
Phenol	0.20	330	10	10

TABLE 3-1

PROJECT-REQUIRED DETECTION LIMITS
ECC SITE

Laboratory Parameter[2]	Project-Required Detection Limits[1]			
	Soil Vapor[3,4] (Vppm)	Soil[5,6] (μg/kg)	Onsite Till Water (μg/L)	Offsite Subsurface Water and Surface Water (μg/L)
Inorganics:				
Antimony	N/A	N/A	0.2	N/A
Arsenic	N/A	N/A	10	0.012[9]
Barium	N/A	N/A	200	N/A
Beryllium	N/A	N/A	5	N/A
Cadmium	N/A	N/A	5	N/A
Chromium VI	N/A	N/A	10	10
Lead	N/A	N/A	3	3
Manganese	N/A	N/A	15	N/A
Nickel	N/A	N/A	40	40
Silver	N/A	N/A	10	N/A
Tin	N/A	N/A	200	N/A
Vanadium	N/A	N/A	50	N/A
Zinc	N/A	N/A	20	20
Cyanide	N/A	N/A	10	0.8[8]
Polychlorinated Bipheynls (PCBs):	N/A	N/A	1[7]	1[7]

Notes

(1) Specific detection limits are highly matrix dependent. The detection limits listed herein are provided for guidance and may not always be achievable.

(2) From Table 3-1 of Exhibit A to the Consent Decree.

(3) The reporting unit is parts per million by volume (Vppm).

(4) The detection limits shown assume a 10-liter sample volume and two 100 mg/50 mg charcoal tubes or one 100 mg/50 mg XAD-7 tube used for sampling.

(5) The detection limits listed for soil are based on wet weight. The detection limits calculated by the laboratory for soil, on a dry weight basis as required by the contract, will be higher.

(6) The detection limits shown for base neutral/acid organics are for low concentration soil samples. The medium concentration soil detection limits are 30 times the individual low concentration soil detection limits shown in the table.

(7) The detection limits shown are higher than the corresponding Acceptable Concentrations specified in Table 3-1 of Exhibit A to the Consent Decree. However, in accordance with Footnote 7 of Table 3-1 of Exhibit A to the Consent Decree, if the detection limits approved by the U.S. Environmental Protection Agency (U.S. EPA) are higher than the Acceptable Concentrations, then the Acceptable Concentrations will be met if the sample results are below the U.S. EPA-approved detection limits (e.g., nondetected result).

(8) These values are lower than the Contract-Required Quantitation Limits specified in the Contract Laboratory Program (CLP) Statement of Work (SOW) being used for this analysis (see Table 7-1). However, CompuChem Laboratories achieved the lower detection limits shown for these parameters during their method detection limit (MDL) study for this SOW. The reporting modifications using these MDLs are described in Appendix A.8.

(9) The actual MDL determined by IEA, Inc. is 1.2 μg/L. However, the sample will be concentrated 100 times before analysis, making the MDL approximately 0.012 μg/L.

TABLE 3-2

PROJECT-REQUIRED ACCURACY AND PRECISION OF FIELD INSTRUMENTS ECC SITE

Field Parameter	Accuracy		Precision	
	Project-Required	Instrument Capability (estimated)	Project-Required	Instrument Capability (estimated)
pH	± 0.10[1]	± 0.01[1]	± 0.10[1]	Not specified
Specific Conductance	± 5.0%	± 3.0%	± 5.0%	Not specified
Temperature	± 1.0°C	± 0.6°C	± 1.0°C	Not specified

Note

[1] Standard pH units.

specific conductance of the solution, or the meter will require recalibration. The sensitivity of the specific conductance meter is 2.5 μmhos/cm on the 0 to 500 μmhos/cm range.

Sample temperature will be measured with the temperature probe on the conductivity meter. The sensitivity of this meter is 0.15°C. According to the manufacturer, the accuracy of the instrument is ±0.6°C; however, the precision of the instrument is not stated. The precision and accuracy of the temperature probe will not be verified in the field because the project-specific precision and accuracy requirements for temperature are sufficiently large that verification is not required. Furthermore, it cannot be easily performed in the field.

3.3 Completeness, Representativeness, and Comparability

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. It is expected that the laboratories will provide data meeting the QC acceptance criteria for 90 percent or better of all investigative samples analyzed, and for 100 percent of the background samples.

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness is a qualitative parameter that is dependent upon the proper design of the sampling program and proper selection of laboratory protocols. The sampling and analysis program is designed to provide data representative of site conditions for evaluation of the effectiveness of the remediation activities. The sampling network, which is specified in Exhibit A to the Consent Decree, was developed giving special consideration to existing analytical results from previous site investigations, the physical setting of the Site, and the type of remedial activity implemented to ensure the representativeness of the data generated by the sampling activities. Representativeness will be achieved using proper sampling and handling techniques (specified in the FSP), i.e., by properly preserving the samples, extracting and analyzing the samples within the required holding times, and using clean and appropriate sample containers. The cleanliness of the sample containers will be assessed by analyzing field blanks, and the adequacy of the sampling procedures will be assessed by analyzing field duplicates.

Comparability expresses the confidence with which one data set can be compared with another. The extent to which existing and planned analytical data will be comparable depends on the similarity of sampling and analytical methods. The procedures used to obtain the planned analytical data, as described in this QAPP, are expected to provide comparable data. These new analytical data, however, may not be directly comparable to existing data because of differences in procedures and QA objectives.

4.0 FIELD SAMPLING PLAN

The FSP for Remedial Action contains all information pertinent to the field sampling equipment and procedures. The FSP is contained under separate cover as Volume II of this QAPP.

5.0 SAMPLE CUSTODY PROCEDURES

This QAPP presents the sample custody protocols described in "NEIDC Policies and Procedures" (EPA-330/9-78-DDI-R, revised June 1985). Sample custody consists of three parts: sample collection, laboratory analysis, and final evidence files. A sample or evidence file will be considered under a person's custody if it: (1) is in a person's physical possession, (2) is in view of the person after he/she has taken possession, (3) has been secured by that person so that no one can tamper with the sample, or (4) has been secured by that person in an area that is restricted to authorized personnel. Final evidence files, including all originals of laboratory reports and field files, will be maintained in a secure area.

5.1 Field Chain-of-Custody Procedures

The field sampling and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the chain of custody intact. The protocols for specific sample numbering are included in the FSP.

5.1.1 Field Procedure

The field custody procedures to be followed by all sampling personnel include:

- The field sampler will be personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible will handle the samples.

- All samples will be tagged with sample numbers and locations.

- Sample tags will be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample label because the ballpoint pen would not function in freezing weather.

5.1.2 Field Logbooks/Documentation

Field logbooks will provide the means of documenting the activities performed at the Site. As such, entries will be in as much detail as possible so that persons going to the Site could reconstruct a particular situation without relying on memory.

Field logbooks will be bound, field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the document control center when not in use. Each logbook will be identified by a project-specific number.

The title page of each logbook will contain the following information:

- Person to whom the logbook is assigned
- Logbook number
- Project name
- Project start date
- End date

Entries into the logbook will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of all sampling team members present, level of personal protection being used, and the signature of the person making the entry will be entered. The names of visitors to the Site and field sampling or investigation team personnel as well as the purpose of their visit will also be recorded in the field logbook.

All measurements will be recorded and all of the collected samples will be described in the field logbook. All entries will be made in ink, and no erasures will be permitted. If an incorrect entry is made, the information will be crossed out with a single strike mark. Whenever a sample is collected or a measurement is taken, a detailed description of the location, which includes compass and distance measurements, shall be recorded. The numbers of the photographs taken of the location, if any, will also be noted. All equipment used to take measurements will be identified, along with the date of calibration.

Samples will be collected following the sampling procedures specified in the FSP. The equipment used to collect samples will be noted, along with the time of sampling, sample description, and volume and number of containers. Sample identification numbers will be assigned prior to sample collection. Field QA/QC samples, which will receive entirely separate sample identification numbers, will be noted under the sample description.

5.1.3 Transfer-of-Custody and Shipment Procedures

The transfer-of-custody and shipment procedures will be as follows:

- Samples will be accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the sampler to another person, to a permanent laboratory, or to/from a secure storage area.

- Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be secured with strapping tape and custody seals for shipment to the laboratory. Custody seals will be attached to the front right and back left of the cooler and will be covered with clear plastic tape. The cooler will be strapped shut with strapping tape in at least two locations.

- A sample analysis request form will accompany each shipment of samples to the analytical laboratory. A description of the requested analysis and the specific laboratory analysis code will be included on this form.

5.2 Laboratory Chain-of-Custody Procedures

The specifications for chain-of-custody and document control for several resource laboratories are described in Attachments A.3 and A.4, C, and D.2, respectively.

5.3 Final Evidence Files Custody Procedures

The contractors will maintain the Remedial Action and water sampling activity evidence files. The evidence files will include all relevant records, correspondence, reports, logs, field logbooks, laboratory sample preparation and analysis forms, data packages, pictures, subcontractor reports, chain-of-custody records, and data review reports. The evidence files will be under the custody of the Contractors' Project Managers in a locked, secure area.

6.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes the procedures for maintaining the accuracy of all the instruments and measuring equipment that are used for conducting field tests and laboratory analyses. These instruments and equipment should be calibrated prior to each use or on a scheduled, periodic basis.

6.1 Field Instruments/Equipment

Instruments and equipment used to gather, generate, or measure environmental data will be calibrated with sufficient frequency and in such a manner to ensure that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Equipment to be used during the field sampling will be examined to certify that it is in operating condition. This includes checking the manufacturer's operating manual and the instructions for each instrument to ensure that all maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that any prior equipment problems are not overlooked, and all necessary repairs to equipment have been carried out. Spare electrodes and probes will be sent with each pH and specific conductance meter to be used in the field.

Calibration of field instruments will be performed at the intervals specified by the manufacturer or more frequently as conditions dictate. Field instruments will include a pH meter and a specific conductance meter. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, it will be returned to the manufacturer for service.

Additionally, personal sampling pumps will be used to collect soil vapor samples. Because a contractor has not yet been selected to perform this sampling, the exact type of pump that will be used is unknown. The contractor that is selected for this task will be required to describe the calibration and operation of the sampling pumps in the contractor QAPP, which will be submitted to the U.S. EPA and IDEM for approval. Appendix F contains example operating and calibration procedures for SKC, Inc. personal sampling pumps.

6.1.1 pH Meter Calibration

The pH meter will be calibrated with standard buffer solutions prior to a field trip. In the field, the meter will be calibrated daily with two buffers before use, as described in Appendix E.1. Thereafter, the meter will be checked against the two buffer solutions after every five samples. Calibration procedures and frequency will be recorded in a field logbook along with the lot numbers of the buffer. The calibration procedure will be as follows:

- Ensure that the temperature of the sample and the buffer is the same.
- Connect the pH electrode into the pH meter, and turn on the pH meter.
- Set the temperature setting based on the temperature of the buffer; place the electrode in the first buffer solution (pH of 7).
- After the reading has stabilized, adjust the "CALIB" knob to display the correct value.
- Repeat this procedure for the second buffer solution (pH 4 or 10), except use the slope adjustment knob to display the correct value.
- Place the pH electrode in the sample, and record the pH as displayed.
- Remove the pH electrode from the sample, and rinse off with deionized water.
- Recalibrated the pH meter every time it is turned off and turned back on, or if it starts giving erratic results.

The calibrations performed, standards used, and sample pH values will be recorded in the field logbook. Appropriate new batteries will be purchased and kept with the meter to facilitate immediate replacement in the field as necessary.

6.1.2 Specific Conductance Meter Calibration

The conductivity cells of the specific conductance meter will be cleaned and checked against known specific conductance standards before each field trip. In the field, the instrument will be checked daily and after every five samples with National Bureau of Standards (NBS) traceable standards. The calibration procedure will be as follows:

- Place the probe in the specific conductance calibration standard solution.
- Set the temperature knob for the temperature of the standard solution.
- Turn to the appropriate scale, and set the instrument for the value of the calibration standard.
- Rinse off the electrode with deionized water.

All readings and calibrations should be recorded in the field logbook.

6.2 Laboratory Equipment

Calibration of laboratory equipment will be based on approved, written procedures. Records of calibration, repairs, or replacement will be filed and maintained by the designated laboratory personnel performing QC activities. These records will be filed at the location where the work is performed and will be subject to QA audit. For all instruments, the laboratory will maintain a repair staff with in-house spare parts or will maintain service contracts with vendors.

For the analyses conducted following the CLP protocols, the calibration procedures and frequencies specified in the applicable SOWs will be followed exactly (see Section 7.0 for the analyses to be conducted). For non-CLP analyses, the appropriate SOPs in Appendices A, C, and D contain the required calibration procedure, frequency, and recordkeeping.

7.0 ANALYTICAL PROCEDURES

7.1 Laboratory Analysis

Table 7-1 provides a list of the analytical methods to be followed by the laboratories for each parameter and the respective appendix in Volume III for the SOP, if applicable. Laboratory methodology to detect and quantify low concentrations of contaminants in the presence of contaminants of high concentration is described in Appendix A.8 (Volume III) of the QAPP, SOP Modifications and Special Considerations. Appendix A.8 also contains modifications to CLP SOW OLM01 and ILM01.0 which enable laboratories to achieve detection limits required for parameters listed in Table 3-1.

7.2 Field Screening Analytical Procedures

The procedures for the field measurement of pH, specific conductance, and temperature are described in the SOPs in Appendix E.

TABLE 7-1

ANALYTICAL METHODS
ECC SITE

Sample Matrix	Laboratory Parameter[1]	Analytical Method[2]	SOP Included in Appendix No.
Soil Vapor	Volatile Organics	NIOSH Methods 1003, 1005, 1015, 1022, 1300, 1500, and P&CAM 127	C
	Phenol	OSHA 32	C
Soil	Volatile Organics	SW-846 Method 8240	A.9
	Phenol	CLP SOW OLM01.0[3]	---
Onsite Subsurface Water and Background-Only Subsurface Water	1,1-DCA	SW-846 Method 8010	A.2
	Other Volatiles	CLP SOW OLC01.0-Modified[4]	---
	BNAs	CLP SOW OLM01.0-Modified[4]	---
	PCBs	CLP SOW OLC01.0-Modified[4]	---
	Chromium VI	SW-846 Method 7195 or 7197	B
	Tin	SW-846 Method 6010	A.1
	Antimony	U.S. EPA Method 200.8	D
	Other Metals	CLP SOW ILM01.0	---
	Cyanide	CLP SOW ILM01.0	---
Surface Water and Investigative-Only Subsurface Water	Volatile Organics	CLP SOW OLC01.0-Modified[4]	---
	BNAs	CLP SOW OLM01.0	---
	PCBs	CLP SOW OLC01.0-Modified[4]	---
	Chromium VI	SW-846 Method 7195 or 7197	B
	Arsenic	U.S. EPA Method 200.8	D
	Other Metals	CLP SOW ILM01.0	---
	Cyanide	CLP SOW ILM01.0-Modified[4]	---
Offsite Background Investigative Subsurface Water (1st year only)	1,1-DCA	SW-846 Method 8010	A.2
	Other Volatiles	CLP SOW OLC01.0-Modified[4]	---
	BNAs	CLP SOW OLM01.0-Modified[4]	---
	PCBs	CLP SOW OLC01.0-Modified[4]	---
	Chromium VI	SW-846 Method 7195 or 7197	B
	Tin	SW-846 Method 6010	A.1
	Arsenic, Antimony	U.S. EPA Method 200.8	D
	Other Metals	CLP SOW ILM01.0	---
	Cyanide	CLP SOW ILM01.0	---

Notes

(1) The specific parameters to be analyzed for each matrix are listed in Tables 1-3 through 1-6.

(2)

NIOSH	=	"NIOSH Manual of Analytical Methods," National Institute for Occupational Safety and Health, Department of Health, Education, and Welfare, 1989 and April 1977.
OSHA	=	Occupational Safety and Health Administration, (OSHA) Analytical laboratory, "Phenol and Cresol," November 1981.
CLP SOW	=	Contract Laboratory Program Statement of Work.
SW-846	=	"Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," SW-846, 3rd Edition, December 1987.
U.S. EPA	=	"Determination of Trace Elements in Water and Waste by Inductivley Coupled Plasma - Mass Spectroscopy, "U.S. EPA Method 200.8, August 1990.

(3) The analysis will be conducted following the protocols in the CLP SOW OLM01.0 and corresponding revisions.

(4) The CLP SOWs will be modified as described in Appendix A.8 (Volume III).

Key

1,1-DCA	=	1,1-Dichloroethane
BNAs	=	Base Neutral/Acids
PCBs	=	Polychlorinated Biphenyls
P&CAM	=	Physical and Chemical Analytical Methods

8.0 INTERNAL QUALITY CONTROL CHECKS

8.1 Field Sample Collection

All the field QC will be carried out in accordance with the procedures described in this QAPP. Field QC will include:

- Sample collection, including MS/MSDs, field duplicates, field blanks, and trip blanks as specified in Section 3.0 for use in the assessment of precision and accuracy, according to the sampling procedures established in the FSP.

- Proper decontamination of sampling equipment after each use, as described in the FSP.

- Proper calibration of the field instruments, as established in Section 6.1 of this QAPP.

8.2 Field Measurements

QA for field measurements of pH, temperature, and specific conductance will be maintained through proper calibration and replication of measurements to ensure reproducibility.

8.3 Laboratory Analyses

The laboratories will implement a QA program and QC checks to ensure the generation of analytical data of known and documented usable quality.

8.3.1 Quality Assurance Program

The laboratories have written QA/QC programs that provide rules and guidelines to ensure the reliability and validity of work conducted at each laboratory. Compliance with the QA/QC program is coordinated and monitored by a QAO at each laboratory, who is independent of the operating departments. Internal QC procedures for analytical services will be conducted by the laboratories in accordance with the corresponding CLP SOW or SOP requirements.

8.3.2 Quality Control Checks

The laboratory QC checks include analyzing sample spikes, surrogate spikes, reference samples, controls, and/or blanks. The frequency of QC checks, the compounds to be used for spikes, and the QC acceptance criteria are described, as appropriate, in the CLP SOWs or the SOP for each analytical method.

9.0 DATA REDUCTION, VALIDATION, AND REPORTING

Procedures for documenting sample collection and custody, validating analytical data, and reporting the results of the remediation activities are covered in this section.

9.1 Data Reduction

9.1.1 Field Measurements and Sample Collection

Field measurements and sample collection data will be recorded in the field logbook. If these data are to be used in the project reports, they will be reduced and summarized, and the method of reduction will be documented in the specific report. Sample custody and analysis requests will be documented on chain-of-custody records and sample analysis request forms.

9.1.2 Laboratory Services

Analytical data reduction will be carried out by each laboratory on its respective data sets. The data reduction will be reviewed and checked as part of the data validation. This will ensure that the actual quantities reported are accurate and appropriately qualified. Compounds detected in blanks will not be subtracted from analytical results of investigative samples and will be reported separately.

With the exception of the non-CLP analyses, the data reduction for the water and soil analyses will follow the appropriate CLP SOWs specified in Section 7.0. Data reduction procedures for the analysis of non-CLP parameters are described in the SOPs included in Appendices A.1, A.2, and D.3. A procedure for data reduction of the soil vapor analyses is described in Appendix C.

9.2 Data Validation

Selected analytical laboratories will perform internal analytical data validation under the direction of the respective laboratory QAOs. The laboratory review will include checks for the attainment of QC criteria as outlined in CLP procedures and the SOPs, as appropriate. The validity of analytical data will also be assessed by comparing the analytical results of duplicate, MS/MSD, and blank samples.

Additionally, the laboratories will critique their own analytical programs by using spiked addition recoveries, established detection limits, and precision and accuracy control charts and by keeping accurate records of the calibration instruments. Data validation procedures to be followed by the laboratories are described in Appendices A.5, C, and D.3.

The Contractors' Environmental QAO will conduct independent data validation of the laboratory analytical results in accordance with the procedures established in the most current U.S. EPA data validation guidelines for the analyses conducted following CLP procedures. For the non-CLP analyses, the independent data validation will be accomplished by comparing the contents of the data packages and the results of the spike, duplicate, and blank samples to the requirements for accuracy, precision, sensitivity, and completeness specified in Section 3.0 of this QAPP. Raw data, such as gas chromatography (GC) chromatograms and data station printouts will be examined to ensure that the reported results were accurately transcribed.

In addition, the independent validation will include: (1) an assessment of whether the samples were properly collected and handled according to the FSP and Section 5.0 of this QAPP, and (2) the identification of any out-of-control data points and data omissions to determine the need to interact with the laboratory to correct data deficiencies.

Finally, the Contractors' QAO will evaluate the data to determine whether they are "confirmed" data. Section 3.3 of Exhibit A to the Consent Decree specifies the use of "confirmed" analytical results to prove compliance. The term "confirmed" permits the ECC Trust to demonstrate that an analytical result is not accurate as a result of errors in sampling, analysis, or evaluation, or that it otherwise mischaracterizes the concentration of a parameter. As specified in Exhibit A to the Consent Decree, the procedures used to obtain "confirmed" data will include re-analysis (within the required holding time), resampling, and the analysis of undiluted samples if a concentration is qualified by the laboratory with a "J" (estimated concentration). In addition, if the concentration of a parameter is still qualified with a "J" after reanalysis and/or resampling with an undiluted sample, then the results produced from undiluted samples will be used. Finally, "B" qualified analytical organic results will be considered as "confirmed" data only if the concentrations in the sample exceed 10 times the maximum amount detected in any blank for the media being analyzed.

9.3 Reporting

Example data package contents from several resource laboratories are described in Appendices A.1, C, and D.1, respectively. Appendix A.1 indicates that the laboratory will provide and retain full analytical and QC documentation similar to that required by the CLP for the analyses to be conducted following CLP protocols (with the modifications described in Appendix A.8) and will provide the data package indicated in Appendix A.2 for the 1,1-DCA analytical results and Appendix A.9 for volatile organics in soil results. A hard copy (paper) of CLP analytical data and supporting documentation as submitted to the Contractor's QAO will be retained. These data may also be retained in other storage media (e.g., magnetic tape).

The following information will be provided to the Contractor in each analytical data package submitted:

- Cover sheets listing the samples included in the report and narrative comments describing problems encountered in analysis.

- Tabulated results of the inorganic and organic compounds shown in Tables 1-3 through 1-6 that are identified and quantified.

- Analytical results for QC sample spikes, sample duplicates, initial and continuing calibration verifications of standards and blanks, standard procedural blanks, laboratory control samples, and Inductively Coupled Plasma (ICP) interference check samples.

- Tabulation of instrument detection limits for inorganics.

- Raw data system including the GC chromatogram and mass spectra printouts or legible photocopies identifying the date of analyses, analyst, parameters determined, calibration curve, calibration verifications, method blanks, sample and any dilutions, sample duplicates, spikes, and control samples.

All of these analytical data will be computerized in a format organized to facilitate data review and evaluation. The data set will include the data flags provided by the laboratories as well as additional flags assigned during the independent data validation. The laboratory-provided data flags will include such items as: (1) concentration below detection limit, (2) estimated concentration as a result of poor spike recovery, and (3) concentration of chemical also found in laboratory bank. These items will be noted on the laboratory analytical reports as letter flags or as comments appended to the reports and will be compiled in the case narrative for each set of samples. The independent data validation flags will indicate that the data are: (1) usable as a quantitative concentration, (2) usable with caution as an estimated concentration, or (3) unusable as a result of out-of-control QC results.

The following data packages will be submitted to the U.S. EPA and IDEM, along with any others that they request in the future, by the contractors:

- Data packages for all samples used to verify soil cleanup as specified in Section 4.2 of Exhibit A to the Consent Decree, including:

    - Soil vapor samples from restart spike tests
    - Onsite till well samples
    - Soil samples

- Data packages for all background subsurface and surface water samples used to modify the site-specific acceptable concentrations listed in Table 3-1 of Exhibit A to the Consent Decree, as allowed by footnotes (2) and (4).

- Data packages for all samples collected for post-soil clean-up compliance monitoring as prescribed in Section 4.3 of Exhibit A to the Consent Decree.

10.0 PERFORMANCE AND SYSTEM AUDITS

The Contractors' QAOs for the ECC Site will monitor and audit the performance of QA/QC procedures to ensure that the Remedial Action is executed in accordance with the FSP and this QAPP.

10.1 Field Activities

QA audits of field measurements, sample collection, and sample custody procedures will be conducted by the Remedial Contractor's Environmental QAO or an appointed alternate on a periodic basis to document that field activities are performed in accordance with the FSP and this QAPP. These audits will be scheduled to allow oversight of as many field activities as possible. An initial audit will be conducted at the start of the project to ensure that all established procedures are being followed. Subsequent periodic audits will be made to ensure continued quality sampling and to correct any deficiencies.

The field audits will include an evaluation of sampling methods; sample handling and packaging; equipment use; equipment decontamination, maintenance, and calibration procedures; and chain-of-custody procedures. In addition, all records and documentation procedures will be reviewed to ensure compliance with the project requirements. Any deviations from the FSP or the QAPP will be recorded in the field notebook by the person conducting the audit, who will then inform the personnel involved in the activity of the problem and notify the Construction Manager for initiation of any necessary corrective action procedures.

10.2 Laboratory

For laboratories performing CLP analysis, all laboratory performance and system audits will be carried out according to CLP requirements, which include external audits by the Region V CRL (Appendix A.6). For non-CLP analyses, QA audits will be the responsibility of each laboratory's QAO. Examples of several performance and system audits can be found in Appendices A.6, C, and D.4.

11.0 PREVENTATIVE MAINTENANCE

11.1 Field Equipment

Preventative maintenance procedures for the pH meter and specific conductance/temperature meter will be those recommended by the manufacturers. Field instruments will be checked and calibrated by the supplier prior to shipment and in the field as described in Section 6.1.

Critical spare parts such as tapes, probes, electrodes, and batteries will be kept onsite to minimize instrument downtime. Back-up equipment will be available by one-day shipment.

11.2 Laboratory Equipment

As part of their QA/QC program, the laboratories will perform routine preventative maintenance to minimize the occurrence of instrument failure and other system malfunctions. The laboratories will designate an internal group who will be responsible for performing routine scheduled maintenance and repairing or coordinating the repair of all instruments with the appropriate vendor. All laboratory instruments will be maintained in accordance with the manufacturer's specifications and the requirements of the specific method being employed. This maintenance program will be carried out on a regular, scheduled basis, and will be documented in the laboratory service logbook for each instrument. Routine preventative maintenance schedules are presented in Appendices A.7, Appendix C, Section 13, page 2 of 2, and Appendix D.1, page 3, Item No. 10.

12.0 SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, AND COMPLETENESS

12.1 Field Measurements

Field data will be assessed by the Contractor's Environmental QA Officer, who will review the field results for compliance with the established QC criteria as specified in the FSP and this QAPP. The accuracy of field measurements will be evaluated by using daily instrument calibration, calibration checks, and analysis of blanks. Precision will be assessed on the basis of reproducibility by collecting multiple readings for a single sample. Data completeness will be calculated by using Equation 12-1:

$$\% \ Completeness = \frac{Valid\ Data\ Obtained}{Total\ Data\ Planned} \times 100 \qquad \text{(Equation 12-1)}$$

12.2 Laboratory Data

Laboratory results will be assessed for compliance with the required precision, accuracy, completeness, and sensitivity as described in the following subsections.

12.2.1 Precision

The precision of laboratory analyses will be assessed by comparing the analytical results between MS/MSD samples for organic analyses, and laboratory duplicate results for inorganic analyses.

The relative percent difference (%RPD) will be calculated for each pair of duplicate analyses by using Equation 12-2:

$$\%RPD = \frac{S - D}{(S + D)/2} \times 100 \qquad \text{(Equation 12-2)}$$

Where:

S	=	First sample value (original or MS value)
D	=	Second sample value (duplicate or MSD value)

12.2.2 Accuracy

The accuracy of laboratory results will be assessed for compliance with the established QC criteria described in Section 3.0 of the QAPP by using the analytical results of method blanks, reagent/preparation blanks, MS/MSD samples, and field blanks. The percent recovery (%R) of MS samples will be calculated using Equation 12-3:

$$\%R = \frac{A - B}{C} \times 100 \qquad \text{(Equation 12-3)}$$

Where:

A = The analyte concentration determined experimentally from the spiked sample

B = The background level determined by a separate analysis of the unspiked sample

C = The amount of the spike added.

12.2.3 Completeness

The data completeness of laboratory analytical results will be assessed for compliance with the amount of data required for decision making. The completeness is calculated using Equation 12-1 as indicated in Section 12.1.

12.2.4 Sensitivity

The achievement of method detection limits depends on the instrument's sensitivity and matrix effects. Therefore, it is important to monitor the instrument's sensitivity to ensure the data quality through appropriate instrument performance. The instrument's sensitivity will be monitored through the analysis of method blanks, calibration check samples, and laboratory control samples.

13.0 CORRECTIVE ACTION

Corrective actions may be required for two classes of problems: sampling and analytical problems and noncompliance problems. Sampling and analytical problems may occur or be identified during the collection, handling, or preparation of a sample; laboratory instrument analysis; and data review.

For problems of noncompliance with the QAPP or the FSP, a corrective action program will be defined in accordance with this QAPP and implemented at the time the problem is identified. The person who identifies the problem is responsible for notifying the Contractor's Project or Construction Manager. Implementation of the corrective action will be confirmed in writing through the same channels.

Corrective actions will be implemented and documented in the field logbook. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by a stop-work order from the U.S. EPA or IDEM.

13.1 Sample Collection/Field Measurements

Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformances, or suspected deficiencies of any activity or issued document by reporting the situation to the Environmental QA Officer. The QA Officer will discuss the suspected problems with the Contractor's Project Manager and if necessary with the ECC Trust, who will then make a decision based on the potential for the situation to affect the quality of the data. If it is determined that the situation is a reportable nonconformance requiring corrective action, the U.S. EPA and IDEM's RPMs will be notified, and a nonconformance report will be initiated by the Contractor's Project Manager.

The Contractor's Project Manager will be responsible for ensuring that any corrective action for nonconformances is initiated by:

- Evaluating all reported nonconformances.

- Controlling additional work on nonconforming items.

- Determining disposition or action to be taken, in consultation with the ECC Trust if necessary and, if warranted by the situation, with the U.S. EPA's and IDEM's RPMs.

- Maintaining a log of nonconformances.

- Reviewing nonconformance reports and corrective actions taken.

- Ensuring that nonconformance reports are included in the final site documentation in project files.

If appropriate, the Project Manager will ensure that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed.

Corrective actions for field measurements may include:

- Repeating the measurement to check the error
- Checking for all proper adjustments for ambient conditions such as temperature
- Checking batteries
- Checking the calibration of the instrument
- Recalibrating the instrument
- Replacing the instrument or measurement devices
- Stopping work (if necessary)

The Contractor's QA Officer will be responsible for all site activities. In this role, the Contractor's QA Officer may have to adjust the site programs to accommodate site-specific needs. When it becomes necessary to modify a program, the Contractor's QA Officer will notify the Contractor's Project Manager of the anticipated change and will implement the necessary changes after obtaining the approval of the agencies. The change in the program will be documented on a Corrective Action Request (CAR) form that will be signed by the Contractor's QA Officer. The CARs will be numbered serially, as required, and will be attached to the file copy of the affected document. The U.S. EPA and IDEM's RPMs must approve the change in writing or verbally prior to field implementation, if feasible. Otherwise, the action taken during the period of modification will be evaluated to determine the significance of any departure from established program practices or the actions taken.

The Contractors' Project Managers are responsible for controlling, tracking, and implementing the identified changes. Reports on all changes will be distributed to all affected parties, including the U.S. EPA and IDEM's RPMs. The RPMs will be notified whenever program changes are made in the field.

13.2 Laboratory Analyses

Corrective actions at the laboratories will be required whenever an out-of-control event or potential out-of-control event is noted. The investigative action taken will be somewhat dependent on the analysis and the event. Laboratory personnel will be alerted that corrective actions may be necessary if:

- QC data are outside the warning or acceptable windows for precision and accuracy
- Blanks contain target analytes above acceptable levels
- Undesirable trends are detected in spike recoveries or in the %RPD between duplicates or MS/MSDs

- Unusual changes in detection limits are identified

- Deficiencies are detected by the QA department during internal or external audits or from the results of performance evaluation samples

- Inquiries concerning data quality are received

Corrective action procedures will often be handled at the bench level by the analyst, who will review the preparation or extraction procedure for possible errors; check the instrument calibration, spike and calibration mixes, and instrument sensitivity; and conduct other QA/QC reviews. If the problem persists or cannot be identified, the matter will be referred to the laboratory supervisor, Project Manager, and/or QA department for further investigation. Once resolved, full documentation of the corrective action procedure will be filed with the QA department. If the problem requires re-sampling or is not correctable in the laboratory, the laboratory QAO will notify the Contractor's Project Manager. The Contractor's Project Manager will decide, in consultation with the ECC Trust and (if warranted by the significance of the problem) with the U.S. EPA and IDEM's RPMs, the corrective actions to be implemented. Further information on corrective action procedures are described in Appendices A.6, C, and D.5.

14.0 QUALITY ASSURANCE REPORT

Quality Assurance reports will be issued by the ECC Trust' Remedial Contractors. These documents will: (1) contain information that summarizes the QA activities in both the field and the laboratory, including audit results; (2) discuss any quality issues that required corrective action and document the corrective action that was taken; and (3) note any project problems that have occurred and any QA/QC issues that have been satisfactorily completed. Any problem serious enough to require significant actions (e.g., changing an approved SOP) will be reported to the U.S. EPA and IDEM's RPMs within 5 days of the occurrence.

15.0 REFERENCES

CH2M Hill, 1983. "Remedial Action Master Plan, Environmental Conservation and Chemical Corporation," 01-5V30.

CH2M Hill, 1986. "Final Remedial Investigation Report. Environmental Conservation and Chemical Corporation, Indiana."

U.S. EPA, 1980. "Internal Guidelines and Specifications for Preparing Quality Assurance Project Plans," QAMS-005/80, Washington, D.C..

U.S. EPA, March 1987. "Data Quality Objectives for Remedial Response Activities," EPA 540/6-87/003.

U.S. EPA, February 1988. "Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses."

U.S. EPA, July 1988. "Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses."

U.S. EPA, Undated. "Content Requirements for Quality Assurance Project Plan," Draft Copy, Dr. Chen-Wen Tsai, Region V.

U.S. EPA, June, 1991. "National Functional Guidelines for Organic Data Review," Draft.

U.S. EPA, 1991. "Model Quality Assurance Project Plan," Region V, Office of Superfund.